TM 31–200

WAR DEPARTMENT

TECHNICAL MANUAL

*

MAINTENANCE AND CARE OF PNEUMATIC TIRES AND RUBBER TREADS

April 20, 1942

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TECHNICAL MANUAL

MAINTENANCE AND CARE OF PNEUMATIC TIRES AND RUBBER TREADS

CHANGES No. 1 } WAR DEPARTMENT, WASHINGTON, August 12, 1942.

TM 31-200, April 20, 1942, is changed as follows:

475493°—42

TABLE II.—*Ordnance gun carriages*

Name	Model	Weight per wheel [1]	Type rim	Wheel size	Tire size	No. ply	Infla-tion	Wheels per unit
37-mm **AA** gun carriage	M3	1, 341	FB	18 x 5	5.50–18	6	**40**	4
37-mm AA gun carriage	M3A1	1, 341	FB	18 x 5	5. 50–18	6	**40**	4
37-mm gun carriage	M4	456	DC	16 x 4. 00 E	6. 00–16	6	**10**	2
40-mm AA gun carriage	M1	1, 362	FB	20 x 5	6. 00–20	6	**35**	4
75-mm gun carriage	M1897A4	1, 504	FB	24 x 6	7. 50–24	8	**35**	2
75-mm gun carriage	M2A1	1, 724	FB	24 x 6	7. 50–24	8	**35**	2
75-mm gun carriage	M2A2	1, 724	FB	24 x 6	7. 50–24	8	**35**	2
75-mm gun carriage	M2A3	1, 700	FB	24 x 6	7. 50–24	8	**35**	2
75-mm gun carriage	M1916A1	1, 605	FB	24 x 6	7. 50–24	8	**35**	2
75-mm gun carriage	M1916M1A1	1, 605	FB	24 x 6	7. 50–24	8	**35**	2
75-mm gun carriage	M1917A1	1, 495	FB	24 x 6	7. 50–24	8	**35**	2
75-mm howitzer **carriage**	M2A1	975	FB	20 x 5	6. 00–20	6	**30**	2
75-mm howitzer **carriage**	M3	1, 012	FB	20 x 5	6. 00–20	6	**30**	2
75-mm howitzer carriage	M3A1	1, 045	FB	20 x 5	6. 00–20	6	**30**	2
105-mm howitzer carriage	M1A1	1, 982	FB	24 x 6	7. 50–24	8	**45**	2
105-mm howitzer carriage	M2	2, 118	FB	24 x 6	7. 50–24	8	**45**	2
8-in. howitzer carriage	M1	3, 055	FB	20 x 9–10	11. 00–20	12	**70**	10
155-mm gun carriage	M1	2, 990	FB	20 x 9–10	11. 00–20	12	**70**	10
155-mm gun carriage (GPF)	M2 and M3	8, 500	FB	24 x 11	14. 00–24	16	**90**	2
	Limber M3	4, 000	FB	20 x 9–10	11. 00–20	12	**70**	2
3-in. AA gun carriage	M1A1	4, 200	FB	22 x 9–10	10. 00–22	12	**60**	4
3-in. AA gun carriage	M2A1 No. 1–6	4, 200	FB	22 x 9–10	10. 00–22	12	**60**	4
3-in. **AA** gun carriage	M2A1 No. 7 and up	4, 200	FB	22 x 9–10	10. 00–22	**12**	**60**	4

[1] Weight includes gun and carriage.
DC—drop center.
FB—flat base.

TABLE II.—*Ordnance gun carriages*—Continued

Name	Model	Weight per wheel	Type rim	Wheel size	Tire size	No. ply	Inflation	Wheels per unit
3-in. AA gun carriage	M2A2	4, 200	FB	22 x 8	10. 00–22	12	**60**	4
90-mm AA gun carriage	M1	4, 400	FB	22 x 8	10. 00–22	12	**70**	4
4.5-in. gun carriage	M1	6, 000	FB	20 x 11	14. 00–20	16	**65**	2
155-mm howitzer carriage	M1917A3	4, 759	FB	24 x 11	13. 00–24	16	**40**	2
155-mm howitzer carriage	M1917A4	4, 500	FB	24 x 11	13. 00–24	16	**40**	2
155-mm howitzer carriage	M1918A1	4, 759	FB	24 x 11	13. 00–24	16	**40**	2
155-mm howitzer carriage	M1918A3	4, 500	FB	24 x 11	13. 00–24	16	**40**	2
155-mm howitzer carriage (new)	M1	6, 000	FB	20 x 11	14. 00–20	16	**65**	2
Caisson, light	M1	1, 000	FB	20 x 5	6. 00–20	6	**40**	2
Limber, light	M2	700	FB	20 x 5	6. 00–20	6	**40**	2
240-mm howitzer transport wagons	**M4 and M5**						**55**	

TABLE III.—*Other ordnance vehicles*

Vehicle	Model	Gross weight	Tire size	No. ply	Inflation	No. wheels per unit	Type rim	Wheel size
Heavy wrecking truck	M1	36,000	11.00–20	12	70	10	FB	20 x 9–10
Bomb trailer	M5	7,000			[1] 40 to 55	4		
Rear tire			7.50–18	8		2	FB	18 x 7.00
Front tire			6.50–22 O. D.	8		2	**Special**	**Special 22 in.**
Bomb service truck	M1					4		
Diamond T		**6,300**	7.50–16	8	**40**		**SDB**	16 x 5.50
Ford		**5,960**	7.50–17	8	**55**		**SDB**	**17 x 6.00**
Yellow Truck & Coach Co		**6,260**	**7.50–16**	**8**	**48**		**SDB**	**16 x 5.50**
Bomb service truck	**M6**	**10,830**	**7.50–20**	**8**	**55**	**4**	**FB**	**20 x 7.00**
Bomb lift truck	M1	2,300	5.00–4	6	55	3	Std. comm. airplane type	4 x 3½ tail wheel.
Half-track car	M2	**17,600**				2		20 x 7.00
Standard tire			**8.25–20**	**10**	**50**		**FB**	
Combat tire			**8.25–20**	**12**	**55**		**Divided**	
Half-track personnel carrier	M3	**17,420**				2		20 x 7.00
Standard tire			**8.25–20**	**10**	**50**		**FB**	
Combat tire			**8.25–20**	**12**	**55**		**Divided**	

[1] **All tires should be equally inflated; pressure to be used will depend on load carried.**

FB—flat base.

SDB—semidrop base.

TABLE III.—*Other ordnance vehicles*—Continued

Vehicle	Model	Gross weight	Tire size	No. ply	Inflation	No. wheels per unit	Type rim	Wheel size
Half-track **81-mm** mortar motor carrier.	M4	**17, 600**	8. 25–20	**10 or 12**		2		20 x 7. 00
Standard tire			**8. 25–20**	**10**	**50**		**FB**	
Combat tire			**8. 25–20**	**12**	**55**		**Divided**	
Welding truck	M1, M2, M3 Marmon.	13, 000	7. 50–20	8	55	6	FB	20 x 7
Emergency repair truck	M1 Herring-ton.	5, 600	7. 50–15	6	40	4	SDB	15 x 5.50 F
	M1 Dodge	7, 140	7. 50–16	6	40	4	FB	20 x 7.00
Scout car	M1	8, 860	8. 25–20	10	45	4	FB	20 x 7.00
	M2	9, 160	8. 25–20	10	45	4	FB	20 x 7.00
	M4	9, 565	8. 25–20	10	50	4	FB	20 x 7.00
	M3A1	11, 660	8. 25–20			4		20 x 7.00
Standard tire				**10**			**FB**	
Front					**40**			
Rear					**65**			
Combat tire				**12**			**Divided**	
Front					**45**			
Rear					**65**			
Mortar motor carriage	M2	9, 660	8. 25–20	10	50	4	FB	20 x 7. 00
Tractor crane trailer	**T26**	**23, 550**	**8. 25–20**	**12**	**65**	**4**	**FB**	**20 x 7. 00**

TABLE III.—*Other ordnance vehicles*—Continued

Vehicle	Model	Gross weight	Tire size	No. ply	Inflation	No. wheels per unit	Type rim	Wheel size
75-mm gun motor carrier	**M3 (T12)**		**8.25–20**	**Std. 10**	**50**		**FB**	
				Combat 12	**55**	**2**	**Divided**	**20 x 7.00**
75-mm howitzer motor carrier.	**T30**		**8.25–20**	**Std. 10**	**50**		**FB**	
				Combat 12	**55**	**2**	**Divided**	**20 x 7.00**
105-mm howitzer motor carrier.	**T19**		**8.25–20**	**Std. 10**	**50**		**FB**	
				Combat 12	**55**	**2**	**Divided**	**20 x 7.00**
Instrument repair truck	M1	13,000	7.50–20	8	**55**	**6**	**FB**	**20 x 7.00**

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[A. G. 062.11 (7-20-42). (C 1, Aug. 12, 1942.)]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:
J. A. ULIO,
Major General,
The Adjutant General.

U. S. GOVERNMENT PRINTING OFFICE: 1942

TECHNICAL MANUAL

MAINTENANCE AND CARE OF PNEUMATIC TIRES AND RUBBER TREADS

CHANGES No. 2 } WAR DEPARTMENT, WASHINGTON, November 5, 1942.

TM 31-200, April 20, 1942, is changed as follows:

47. Care of full tracks.

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b. Reversing worn track blocks.—To increase the life of tracks, rubber blocks may be reversed in the following ways.

* * * * * * *

(2) When the entire surface * * * and put back.

Caution: Dented or deformed links or tubes cannot successfully be retreaded because they will not fit.

NOTE.—In replacing single blocks which have worn out or become damaged, replacement should be made with a block that has about the same amount of wear as the remaining blocks in track.

(3) The standard reversible-type rubber block tank track will be turned when the rubber on the first side has either worn to the extent that wear on the steel end links is imminent, or when the rubber has cracked over the cross tubes to such an extent that separation of the rubber from, and exposure of, the cross tubes is imminent, whichever condition shall occur first.

(4) The standard reversible-type rubber block tank track will be removed when the rubber on the second side has worn to the extent that wear on the steel end links is imminent.

(5) The nonreversible-type rubber block tank tracks will be removed when the rubber on the ground side has worn to the extent that wear on the steel end links is imminent.

(6) The rubber block tank track with steel Burgess Norton Adapter will be removed when the steel shoe has worn to the extent that it no longer provides traction or when wear on the end links is imminent.

(7) Tank tracks which are operated on roads have a tendency to wear faster on the right-hand side of the vehicle. Left-hand tracks should either be combined with other tracks of equal wear or tracks should be switched from one side of the vehicle to the other in order to obtain maximum wear from all tracks.

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[A. G. 062.11 (10-1-42).] C 2, Nov. 5, 1942.)

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49. Care of bogie wheels.

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c. Bogie wheels will be removed and replaced when the rubber has worn down even with the height or the rim flanges. Bogie wheel tires which have rubber along one or both sides scooped out, due to cutting action of the track end connectors or track guides, need not be changed unless there is not a continuous band of rubber all the way around the center portion of the wheel.

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[A. G. 062.11 (10-1-42).] (C 2, Nov. 5, 1942.)

51. Half-track vehicles.

* * * * * * *

d. Half-track tracks will be removed when the rubber on the ground side has worn to the extent that wear on the steel cross bars and exposure of the cables is imminent. Quite often the rubber will separate from and expose the cross bars before the track is worn out. When this condition occurs the tracks may be run until wear on the cross bar is imminent.

[A. G. 062.11 (10-1-42).] (C 2, Nov. 5, 1942.)

53. Care of tracks on half-track vehicles.

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e. Half-track tracks which are operated on roads have a tendency to wear faster on the right-hand side of the vehicle. Left-hand tracks should either be combined with other tracks of equal wear or tracks should be switched from one side of the vehicle to the other in order to obtain maximum wear from all tracks.

[A. G. 062.11 (10-1-42).] (C 2, Nov. 5, 1942.)

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TECHNICAL MANUAL No. 31-200 } WAR DEPARTMENT, WASHINGTON, April 20, 1942.

MAINTENANCE AND CARE OF PNEUMATIC TIRES AND RUBBER TREADS

CHAPTER 1

QUARTERMASTER VEHICLES

SECTION I

GENERAL

*This manual supersedes TM 31-200, January 1, 1942.

1. Importance of tires.—Today's mechanized Army depends to a great extent on pneumatic tires for its flexibility, speed, and maneuverability over terrain which once was impassable except on foot or horseback. With a few exceptions, Army vehicles actually move on air—air within a covering of cord and rubber. Serving as the contact between the vehicle and the road, this covering is exposed to road

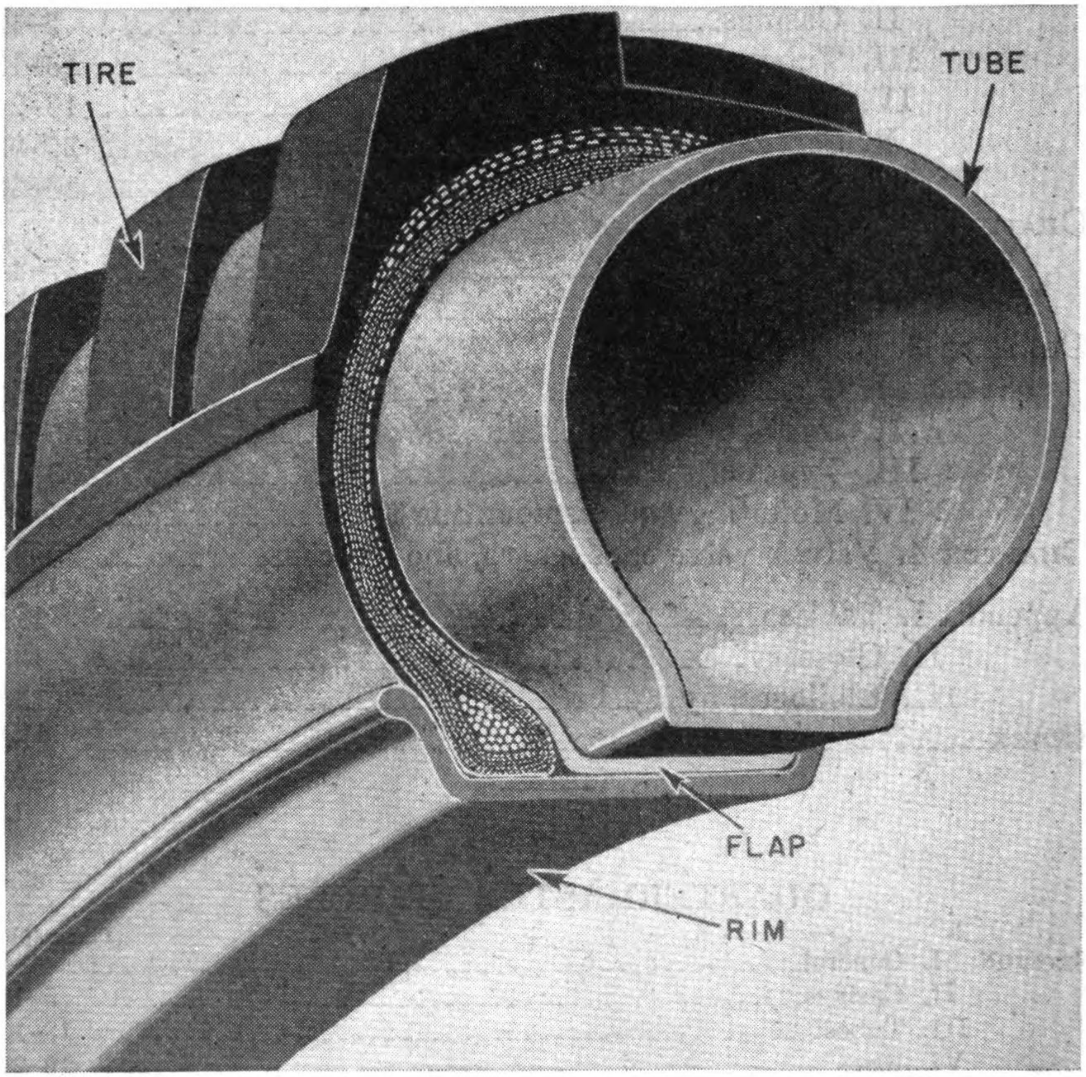


FIGURE 1.—Pneumatic tire assembly.

shocks, cuts, and bad weather. When anything happens to it or the tube, letting the air escape, the vehicle loses its support and most, or all, of its usefulness.

2. Parts of tire assembly.—The tire assembly consists of a strong outer covering called the casing; an airtight container called the tube; and a metal base, called the rim. The casing alone is often referred to as a tire. Improper care and handling of any of these parts may cause all of them to fail.

3. Tire service.—The construction of the tire enables it to withstand, without immediate failure, abuses that will gradually ruin it. For example, a tire with insufficient air pressure will run for some distance before damage already done becomes apparent. However, such abuse gradually destroys the casing, making it unable to withstand normal use. A cut or a stone imbedded in the casing may in time ruin the whole tire. Improper mounting or improper use of tires has similar destructive effects.

4. Effect of oil, grease, and gasoline.—*a.* The harmful effect of oil, grease, and gasoline on rubber is generally known, but precautionary measures to prevent contact are frequently neglected. Tires and rubber tracks come in contact with oil, grease, or gasoline for various reasons. Petroleum products slowly rot rubber, and the damage is usually unnoticed until too late. The rubber becomes soft and spongy and has much lower heat and wear-resisting qualities. It is, therefore, essential that great care be exercised in keeping tires and tracks free from oil.

b. When a lubricant is required to facilitate the installation of tires, soap should be used. This can be either soapy water or a bar of soap applied to the tire beads and rim.

SECTION II

CASINGS

Paragraph

5. Casing.—The casing, commonly called the tire, has five main structural parts (fig. 2): plies, bead, cushion, breaker, and tread. The plies and bead together are called the carcass. In locating damage, however, it is better to refer to the regions involved: shoulder, tread or crown, sidewall, or bead.

a. A ply is a layer of rubberized cotton or rayon cords which run diagonally across the tire. The cords in each ply are at an angle to the cords in the next ply.

b. (1) The bead is constructed of wire hoops over which the plies are looped. These hoops keep the tire from stretching and prevent it from jumping off the rim. The bottom and side of the bead are

shaped to fit the rim. The bottom may be flat or slightly tapered, and the side is flat. The height varies with the size.

(2) The shape of the bead is highly important. Unless it conforms with the rim, the casing will not be supported properly and may blow off or be damaged.

c. The breaker is a soft layer of cords between the tread and the carcass. It is similar to the plies except that the cords are farther

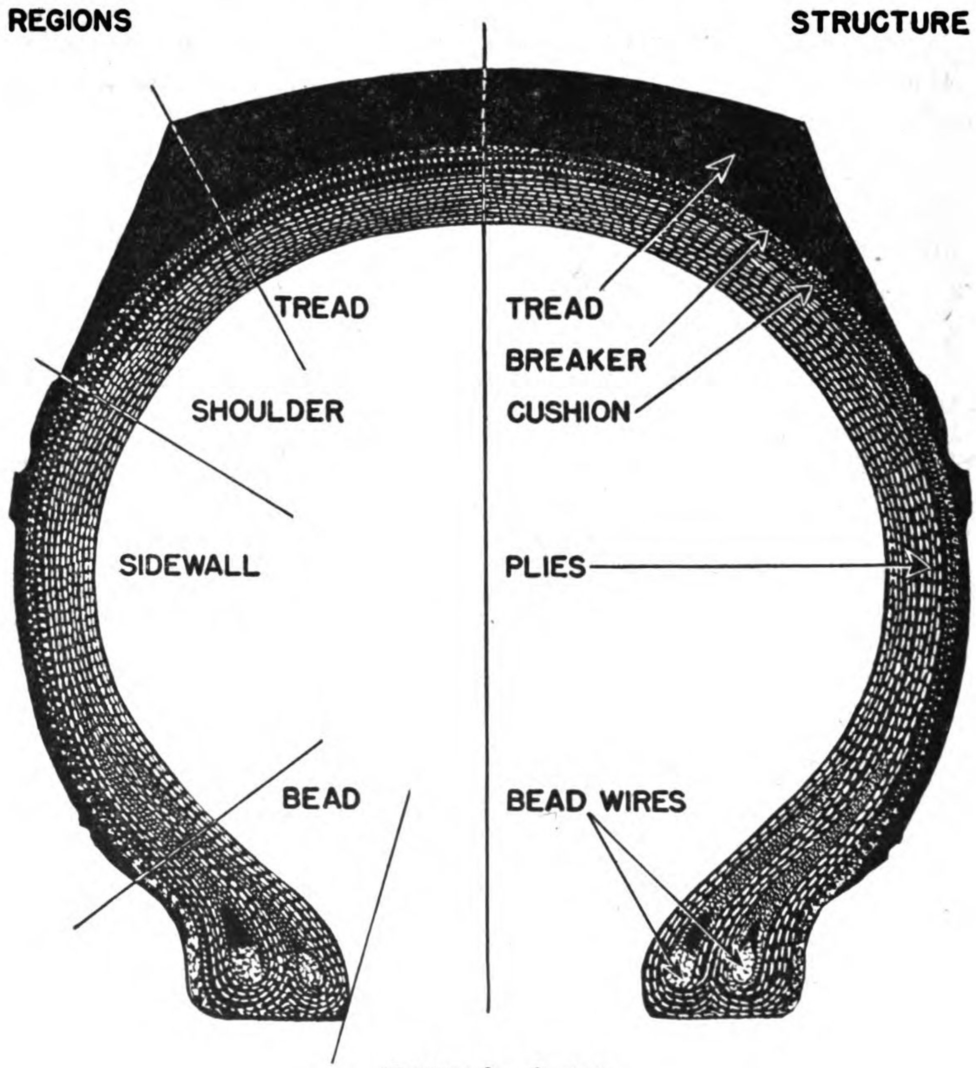


FIGURE 2.—Casing.

apart. The breaker distributes road shocks over a larger area and prevents the tread separating from the carcass.

d. The cushion, made up of two layers of soft rubber, one above and one below the breaker, binds the breaker to the carcass and the tread. It helps absorb road shocks.

e. The tread, made of rubber, usually has a nonskid design. It protects the carcass from cuts and wear and by extending all the way around from bead to bead makes the carcass waterproof. Spe-

cial treads are designed to meet special operating conditions (see par. 9).

6. Markings on tires.—*a.* The size is marked on the side of each tire, for example, 7.50-20/8 or 7.50-20—8 ply. The first figure, 7.50, is the width in inches when the tire is properly mounted on the rim and inflated but not carrying a load. The second figure, 20, is the inside diameter of the bead in inches. The third figure, 8, is the number of plies. If the bead diameter is smaller than the rim diameter, the tire cannot be mounted; if the bead diameter is larger than the rim diameter, the tire will not be retained by the rim flange. Although it is possible to mount tires of greater or less width than that recommended, the life of the tire may be shortened, and the tire may even blow out. Tire sizes are listed in appendix I, together with their corresponding recommended rim sizes.

b. A small red mark on the sidewall of the tire shows where the tube valve should be placed to balance the tire and tube.

7. Flexing.—As the tire rolls, each section of it successively supports the load. Each section, upon reaching the bottom is squeezed, then springs back into shape as the tire rolls on. The sidewall is designed to flex slightly to allow for this changing shape. However, excessive flexing due to underinflation overheats and stretches the cords and may break them or grind them away. Consequently, the casing may become so weak that it will blow out. Figure 3 shows casings which have been destroyed by excessive flexing.

8. How to avoid excessive flexing.—*a. Air pressure.*—(1) Excessive flexing can be avoided by maintaining the proper air pressure in the tube. This is the most important point in tire maintenance, yet the one most often neglected. The air pressure should be checked with a gage (par. 79) at frequent intervals—before every operation, if possible. If a tire leaks continuously, locate and eliminate the cause. Whenever air is added, the valve should be checked for leaks (par. 77). Beside keeping dirt out of the valve, valve caps are a positive seal. Missing valve caps must be replaced.

(2) Prescribed air pressures are for tires having the same temperatures as the outside air. Since heat increases air pressure, the pressure will rise during normal operations. The original correct pressure must not be reduced while the vehicle is being operated because reduction of pressure will increase the internal heat of the tire and will result in blow-outs.

b. Load.—Vehicle capacity is rated according to definite weight distribution, and tires are selected to carry each wheel's propor-

tionate share of the total load. Consequently, piling the load on one corner of the vehicle may overload the tire or tires involved, even though the total load is far below the rated vehicle capacity.

9. Tread design.—The tire is the only connection between the vehicle and the roadway. For that reason, the tread design is important in starting, stopping, climbing, and steering—the factors upon which vehicle control depends. Poor control seriously interferes with the vehicle's usefulness and safety. Proper tread designs

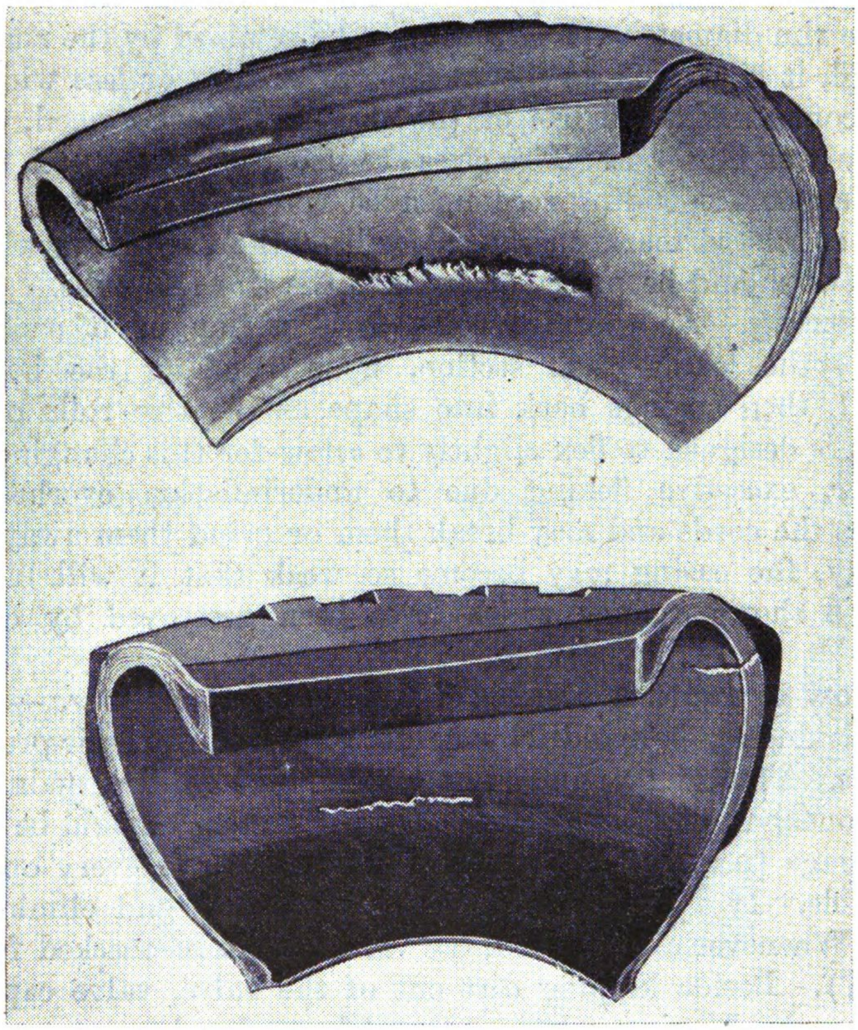


FIGURE 3.—Flex breaks.

are selected for all Army vehicles, and except in an emergency, the type should not be changed without authorization. A tire with the tread worn off is almost useless and should be replaced with a good tire. Generally, all tires on the vehicle should have the same tread design, and approximately the same outside diameters (see par. 21). On some vehicles, the design of the front or steering tires may differ from that of the rear or driving tires.

a. Types of tread designs.—Tread designs similar to that shown in figure 4 are known as the high-traction nondirectional type. Other commonly used designs include the high-traction directional

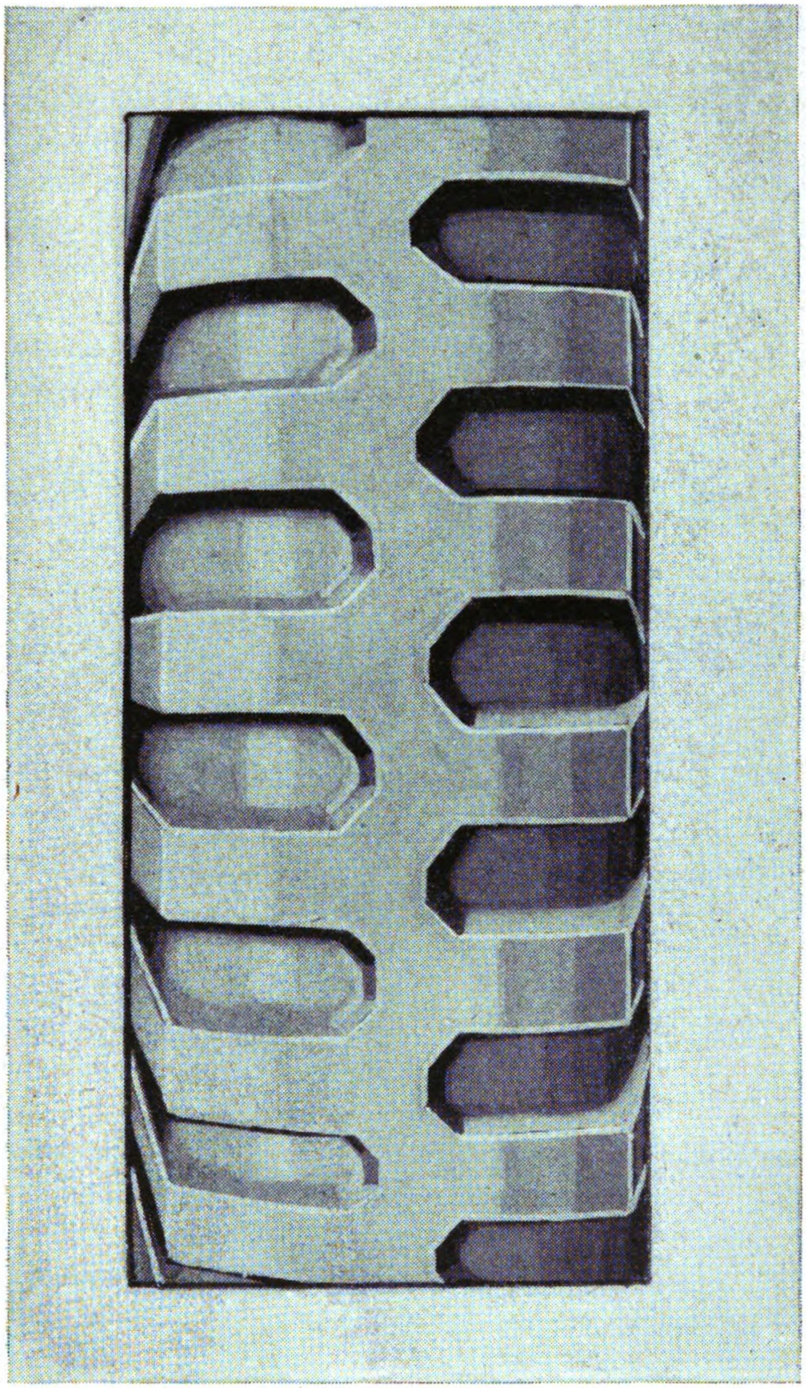


FIGURE 4.—High-traction nondirectional tread.

type (fig. 5) and the conventional type (fig. 6). The high-traction types provide traction on nearly all surfaces, but are not selected for special wearing qualities. The conventional tread has good wearing

qualities, and provides about equal resistance to forward and lateral slipping on hard surfaces. Special-purpose treads can provide traction on very soft surfaces, or high resistance to sideslip, or low rolling

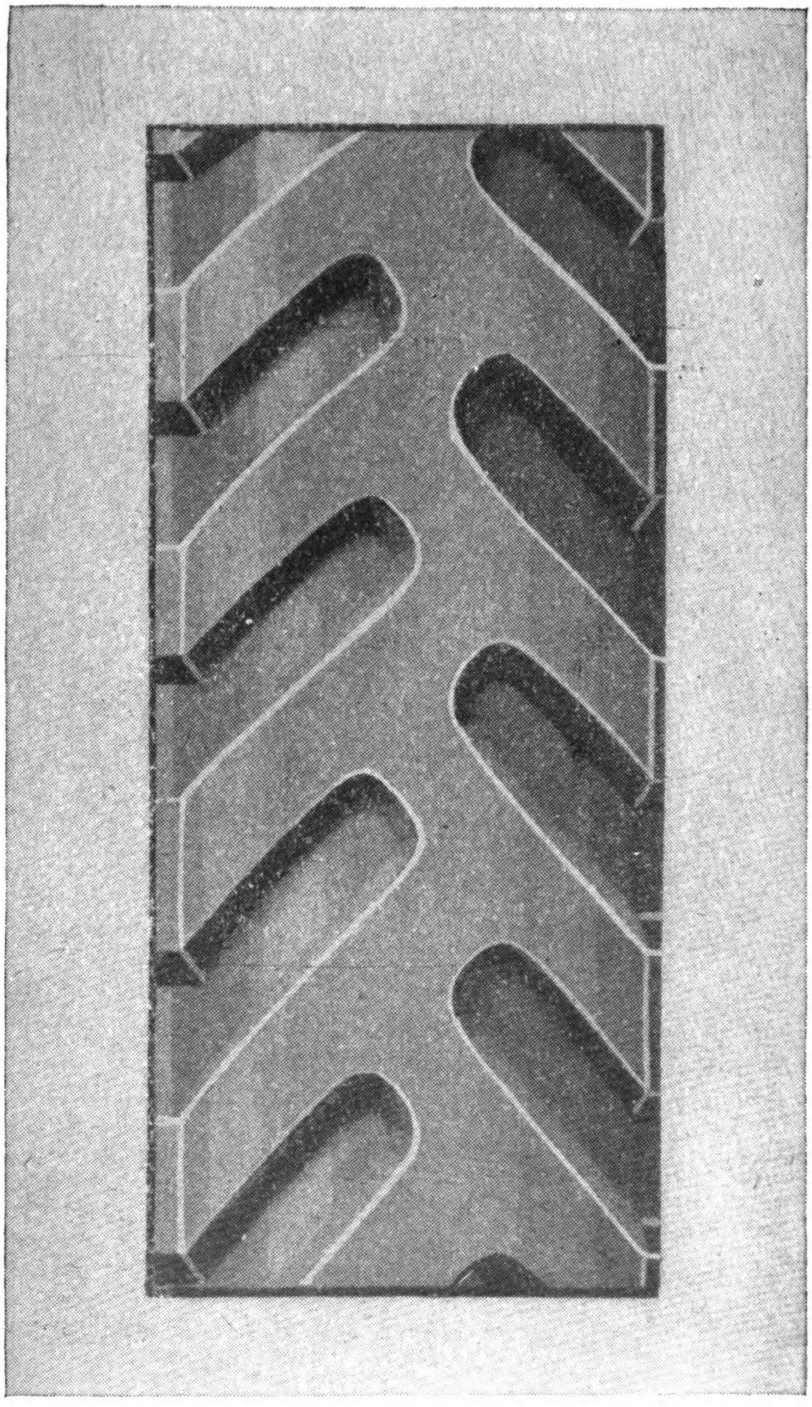


FIGURE 5.—High-traction directional tread.

resistance. It is often necessary to sacrifice one desirable quality to obtain another more important quality for particular service.

b. Directional and nondirectional treads.—(1) Directional tread

tires must be mounted on all rear wheels so the point of the **V** meets the ground first, because in this position the tread is self-cleaning and offers maximum traction. This is the normal mounting for a directional tread. When the point of the **V** touches last, mud tends to pack into the tread, forming a smoother surface which gives less traction.

(2) Directional tread tires mounted on wheels of front-driving axles in the normal or directional position, wear more rapidly than they do when reversed. Therefore, they should be reversed on all front wheels, driving or nondriving (so the open part of the **V** meets the ground first), except when driving conditions make it necessary to get the greatest possible traction.

(3) When rotating directional tires (par. 30) be sure that the direction of each is correct in its new position.

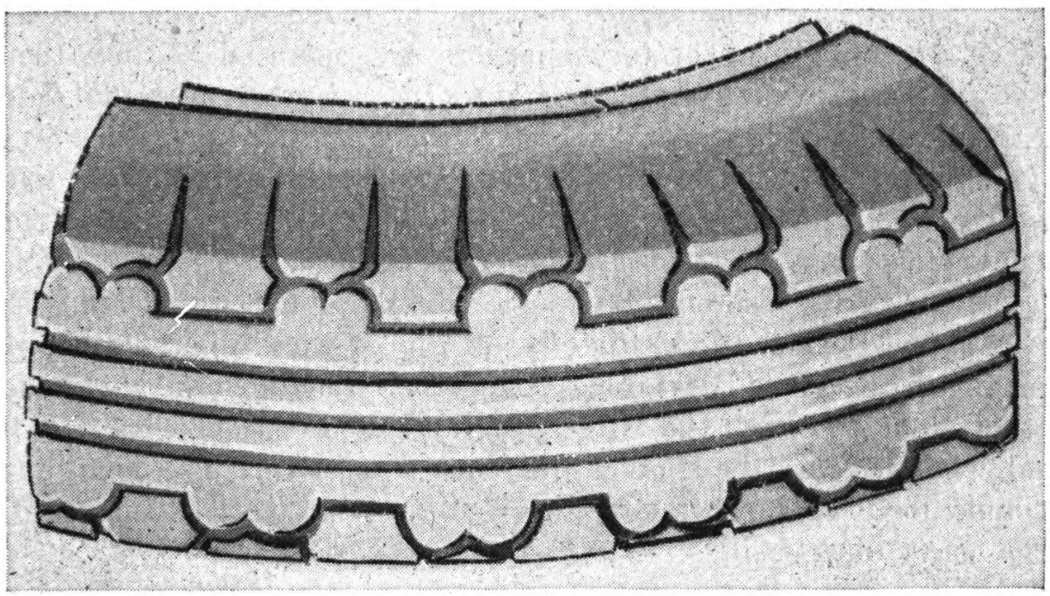


FIGURE 6.—Conventional tread.

(4) Nondirectional and conventional tires have the same tractive and wearing qualities regardless of direction.

10. Run-flat or combat tires.—*a.* Run-flat or combat tires, also called bullet-resisting tires, differ from other casings in that the sidewalls are more rigid and the plies are more heavily cushioned and farther apart. The inner surface is heavily coated with rubber. These casings are mounted on combat rims (par. 20). They are constructed and mounted so that they will operate without air.

b. They are not bullet-resisting in the sense that they cannot be punctured by a bullet. The run-flat feature provides traction and support even though the tire is not inflated. If they are punctured,

however, they must be repaired at the earliest opportunity. For full details on combat tires and rims see chapter 2.

11. Storage.—Correct tire storage is a very important part of tire maintenance. Tires can be stored up to 3 years, but unless proper precautions are taken, they may be ruined in less time.

a. Causes of tire decay.—Rubber is rotted by light, heat, air in motion, ozone (from sunlight and the electrical discharge of motors and generators), oils, dust, and dirt. Obviously, stored casings will last longer if protected against these elements.

b. Storing new or dismounted tires.—(1) Stored tires should be kept in a closed, clean, dark, cool, dry, room. A tarpaulin or other heavy, tightly woven fabric should be placed over the tires to further curtail the effects of light, moving air, and dirt. To reduce the destructive effect of heat, the temperature of the storage room should not exceed 70° to 80° F.

(2) Stored tires should not be kept in rooms in which electric motors, generators, or battery chargers are operated because these devices release oxygen and ozone into the air when operated, and these substances have a very destructive effect on rubber.

(3) Tires should not be stored in the same or adjoining rooms with gasoline and lubricants because the solids, fluids, or vapors from them are readily absorbed by rubber and rot it.

(4) The casings should be racked or piled flat on clean wood strips about ½-inch thick, directly on top of each other, with only casings of the same size piled together. "Lacing," or any other method, tends to kink the wire beads and distort the casings. The smaller the casing, the shorter the stack should be. The maximum recommended heights range from 7 feet for 5.50 tires to 15 feet for large heavy-duty casings.

(5) Used tires should be cleaned and repaired before they are stored.

(6) Tires which were first placed in storage should be the first to be issued when tires are needed. Wherever possible, the supply of needed tires from storage will take precedence over the supply from current production or current receipts.

(7) Carbon dioxide fire extinguishers should be provided in tire storage rooms.

c. Storing mounted tires.—(1) Vehicles in storage should be placed on blocks so that the weight does not rest on the tires, and the air pressure should be reduced to only a few pounds. If the vehicle cannot be blocked up, the air pressure recommended for the tires should be maintained.

(2) Tires that must remain outdoors should be coated with a synthetic rubber paint as a protective covering. A cover or wrapping of heavy canvas, or a similar material, can be used for the same purpose. The same precautions observed for storing new tires hold for used tires.

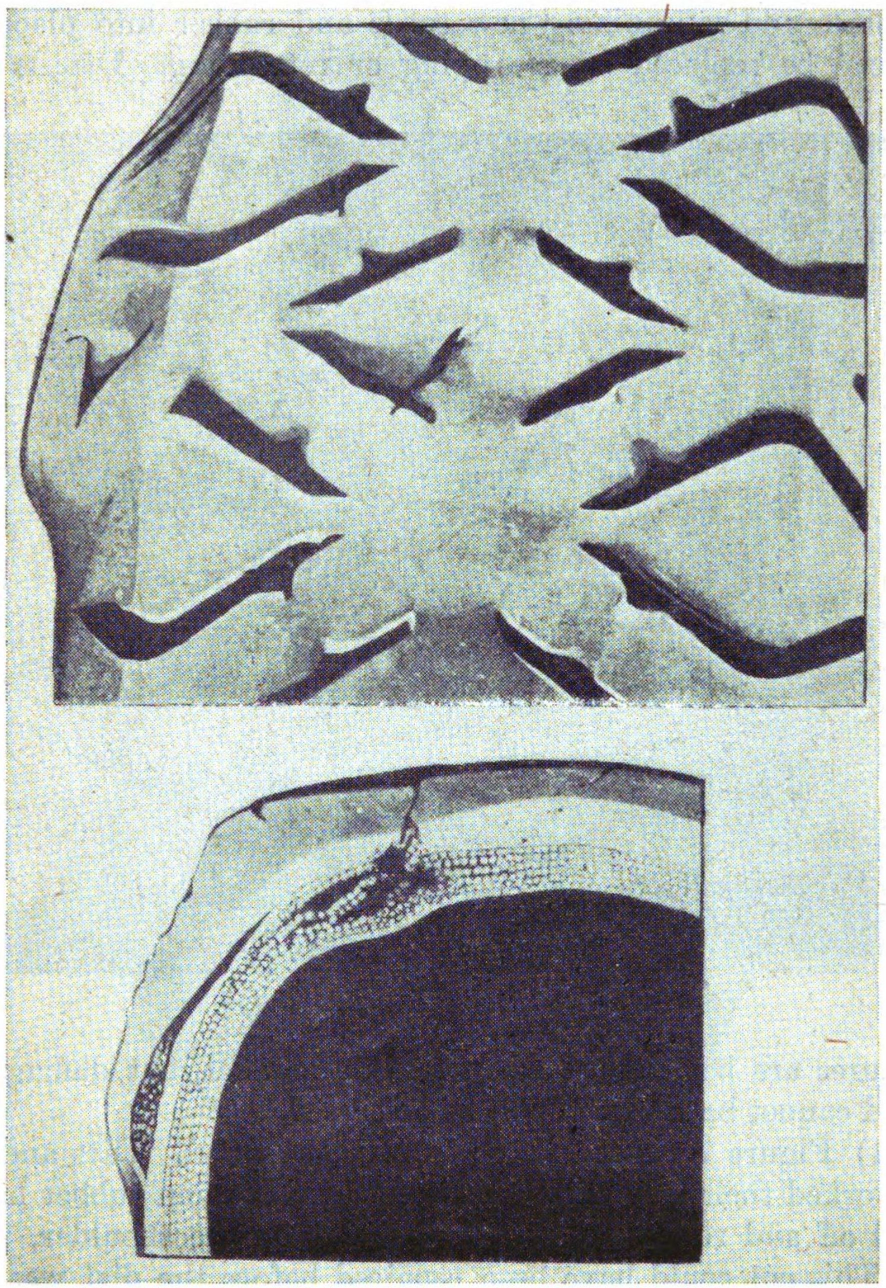


FIGURE 7.—Cut in tread, showing effect on casing.

(3) When storing mounted tires and wheels off the vehicle, the air pressure should be reduced to a few pounds and the assemblies piled in the same manner as new tires. The stacks should not be higher than 5 feet.

12. Repair of casings.—*a.* (1) Negligence is directly responsible for ruining many tires. Most tire injuries are reparable in their early stages. Using any injured tire is hazardous, since it may blow out, destroy the tube, and possibly cause the driver to lose control of the vehicle.

(2) Satisfactory casing repairs are made by cutting out all damaged parts and vulcanizing new cords and rubber into place. The tread can be replaced by recapping or retreading. Details of the

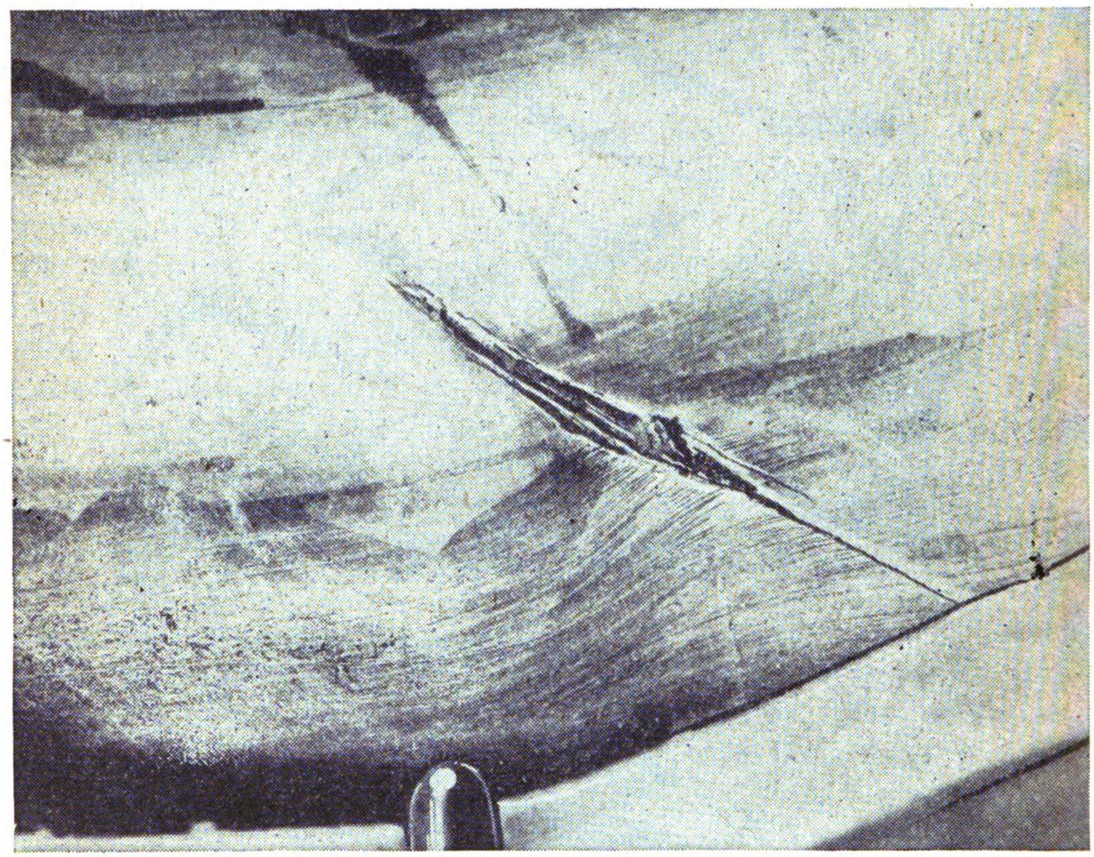


FIGURE 8.—Cut through casing (internal view).

procedures are beyond the scope of this manual, but damages that can and cannot be repaired will be discussed.

b. (1) Figure 7 shows a large cut in the tread. Dirt and water have worked their way through the cut, and cushion rubber has been ground off and rolled up, causing a bulge on the shoulder.

(2) This cut could have been repaired before the dirt was forced between the rubber and cords, but now separation of the plies has started and so much material must be removed to find a solid base that repair is impossible.

c. Figure 8 shows a cut all the way through the casing. The tire was not repaired, and the flexing broke several cords, weakening the

casing. This damage is not reparable. If caught in time, this type of damage can be repaired by vulcanizing in new cords and rubber.

d. Figure 9 shows a tire that has been run flat and damaged beyond repair.

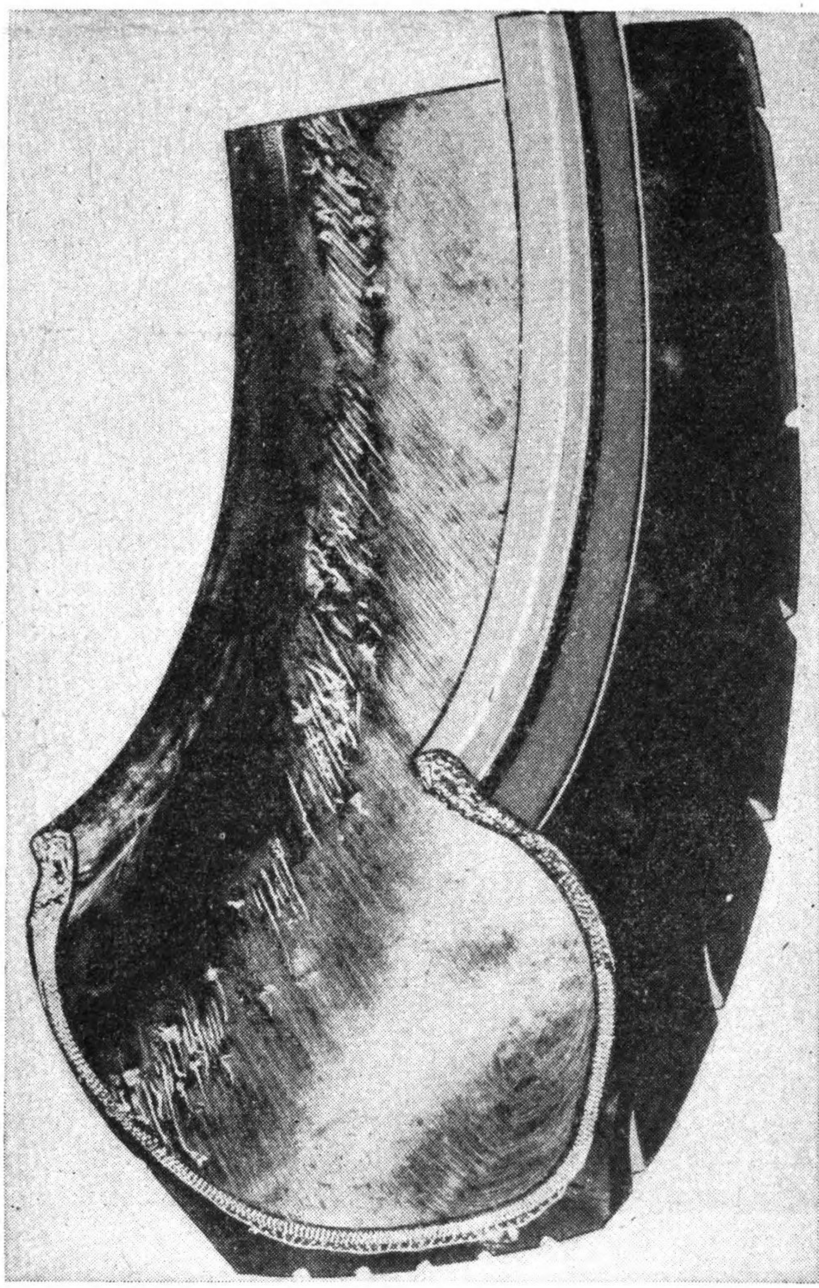


FIGURE 9.—Tire damaged by running flat.

e. Figure 10 shows a cut or snag on the sidewall which has damaged and exposed the cords. Besides weakening the casing, water will seep through the entire length of cords, rotting them and causing extensive damage. This tire is still reparable. If the cords should rot down to the bead, however, it cannot be repaired.

f. A hole which has not broken enough cords to weaken the casing materially will allow water to seep through and rot the exposed cords. Punctures of this kind are best repaired by a vulcanized patch.

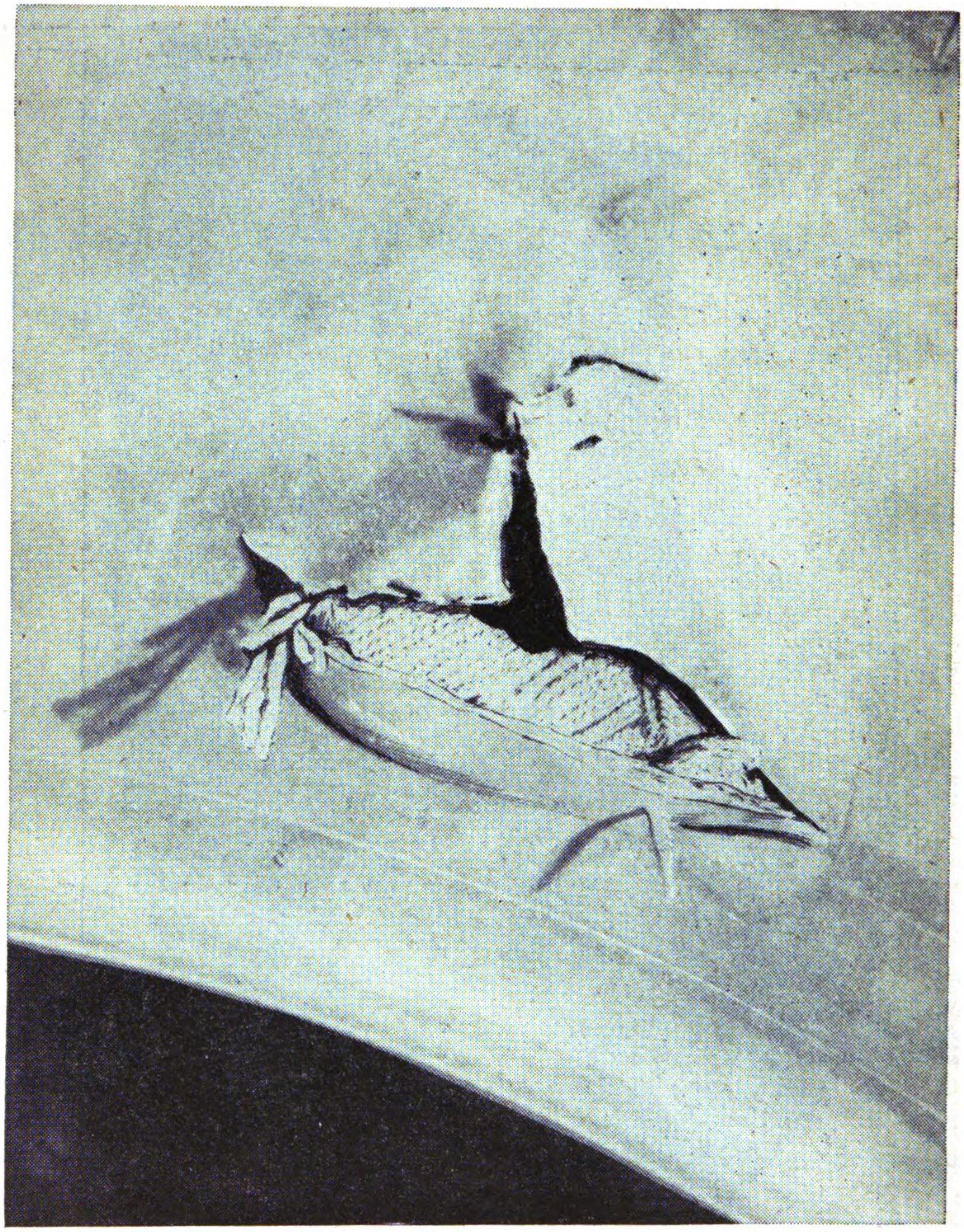


FIGURE 10.—Sidewall injury.

g. A break inside the casing forms an opening into which the tube or a temporary patch, if used, is forced by the air pressure. Flexing wears the tube or patch and breaks more cords. Breaks inside the casing can be repaired by vulcanizing if caught in time.

h. Temporary boots or casing patches do not properly support the casing at the break. Furthermore, their weight unbalances the cas-

ing and also causes a bulge, which wears the tread unevenly. Boots in the front tires may unbalance them enough to interfere seriously with steering. Boots may be used only in an emergency and there-

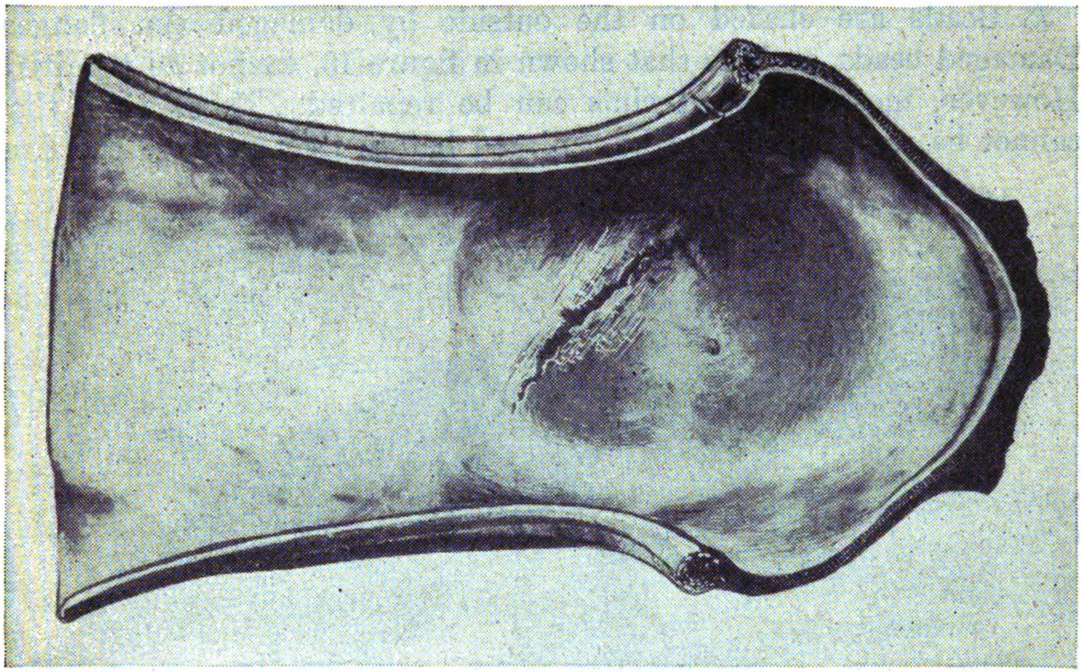


FIGURE 11.—Tire ruined by temporary boot.

fore the casing must be permanently repaired as soon as possible. Figure 11 shows a tire after a boot has been used. This tire is now beyond repair.

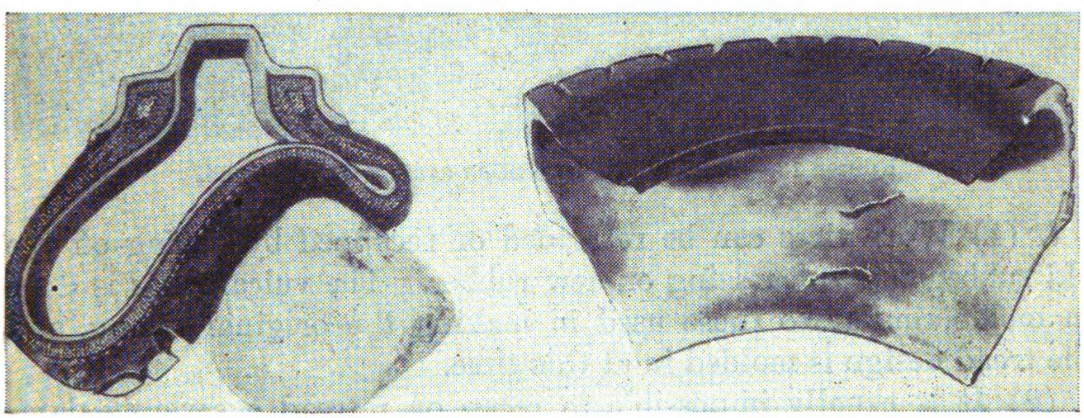


FIGURE 12.—Rim bruise.

i. Separations between the carcass and the tread or between the plies reduce the strength of the casing enough to cause a blow-out. They are generally caused by heat, are evidenced by a bulge, and are not reparable.

j. Inside rim bruises (fig. 12) are caused by the casing being pinched between some object and the rim. They are often caused by running over sharp objects such as curbs and rocks or jamming the casing against them.

k. Beads are chafed on the outside by damaged rim flanges. Damaged beads, such as that shown in figure 13, cannot be repaired. However, most damaged rims can be repaired. Those rims that cannot be repaired should be replaced before they damage the tire.

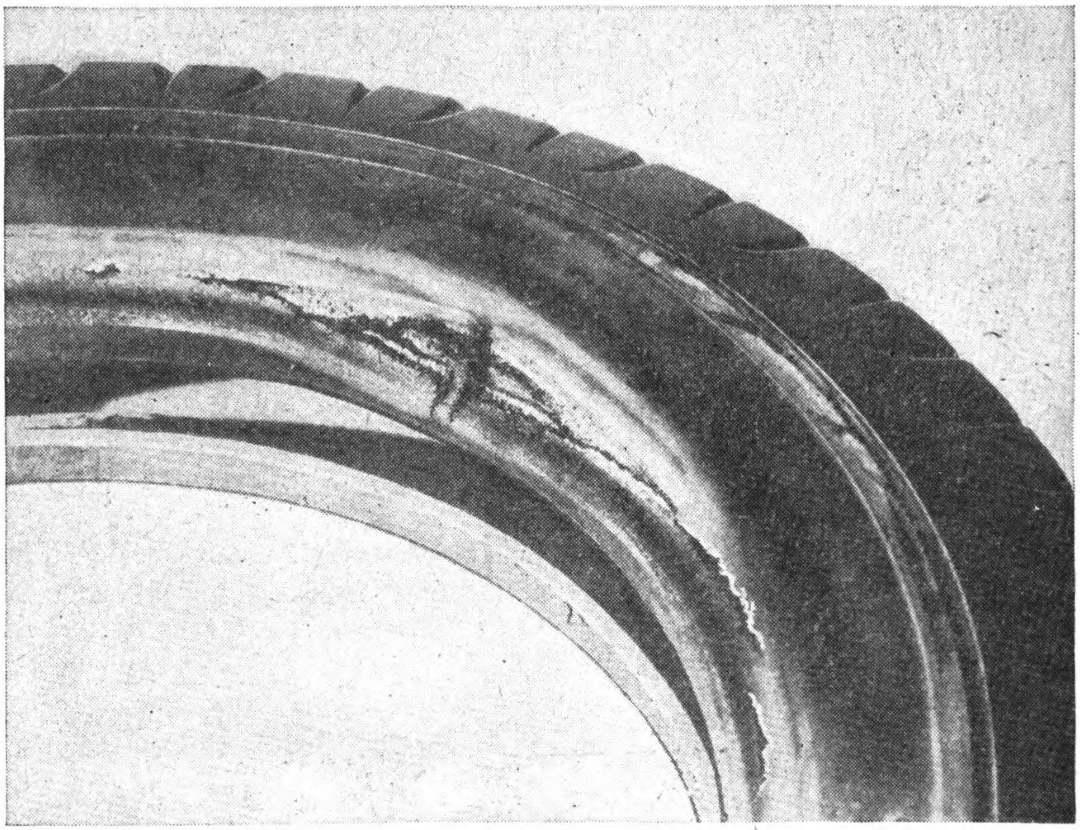


FIGURE 13.—Bead ruined by chafing against damaged rim.

l. (1) Worn tires can be retreaded or recapped by buffing off the old rubber and vulcanizing on new rubber. The vulcanizing is done in molds similar to those used in making the original casing, and the tread design is molded in at this time.

(2) It is usually impossible to recap or retread a severely damaged carcass.

(3) Tires should be removed as soon as the tread design begins to disappear, because they do not have proper traction. Further use will increase the danger of ruining casings.

Section III

TUBES

13. Tube.—The tube, which has no function other than holding air, is strong enough in itself to withstand only a few pounds of air pressure. When inclosed by the casing and the rim, however, it can

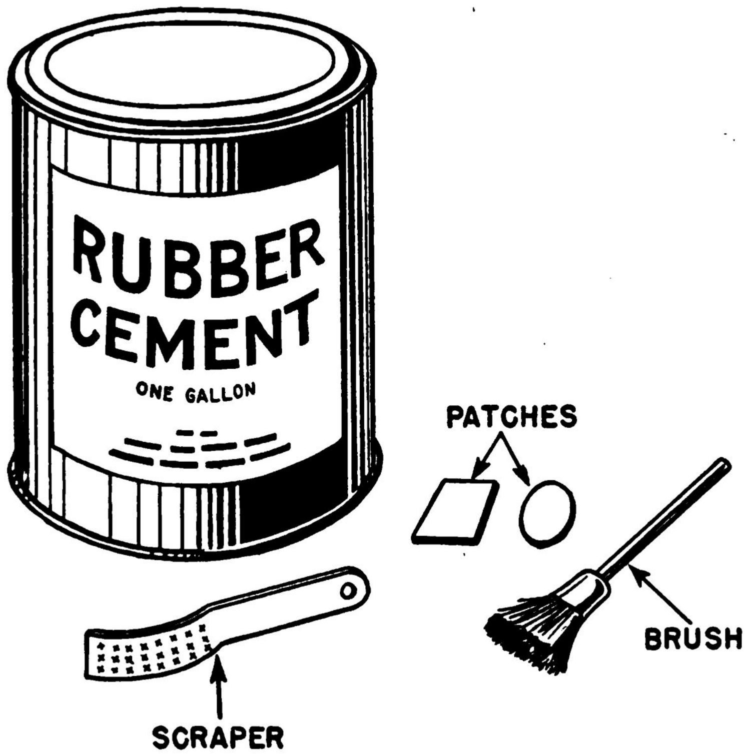


FIGURE 14.—Cold patch kit.

withstand extremely high pressures. Made of comparatively soft rubber, it is easily chafed and damaged. The inside of the casing must always be smooth before mounting a tube.

14. Kinds of tubes.—*a.* Plain tubes are made of a single thickness of rubber. It is generally in one piece and molded into the shape of a doughnut. A valve that permits inflation is attached to the tube as described in chapter 4.

b. Puncture-sealing or bullet-sealing tubes are coated inside with soft, spongy rubber which is automatically forced into a puncture. These tubes are readily identified by their weight and stiffness.

Keeping puncture-sealing tubes deflated even for a short time packs the coating and destroys its effectiveness. They should be kept inflated except when they are being installed, removed, or repaired. For further information, see chapter 2.

15. Tube replacement.—*a.* The tube stretches to the shape and size of the inclosure formed by the casing and the rim. Within limits, therefore, one size of tube can be used with several sizes of casings.

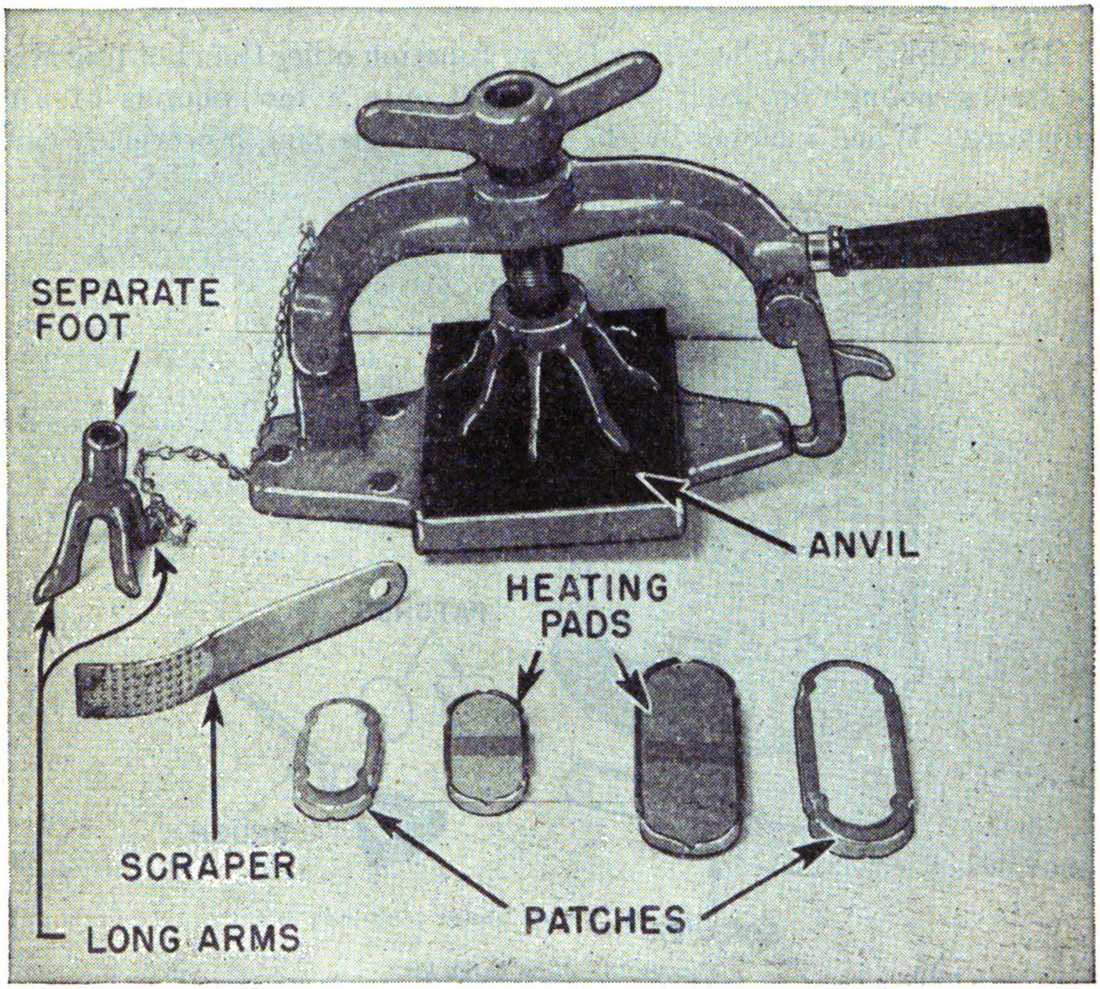


FIGURE 15.—Hot patch kit.

The size marking, stamped on the tube, shows the casing sizes with which it may be used. A new tube may be selected by size. Used tubes, however, stretch; therefore they must always be fitted (par. 17).

b. Tubes become thin from use and lose their strength. Generally, a new tube should be used in a new casing. Puncture-sealing tubes, however, may outwear several casings.

16. Repairing punctures.—A puncture in a tube is repaired with a rubber patch. Tubes are repaired by the cold or hot patching method.

a. Cold patching is done with the kit shown in figure 14. Clean ½ to 1 inch around the hole and roughen it with the scraper. Next, coat the area with rubber cement, allowing it to become tacky or sticky. Then remove the protective cloth from the patch, keeping the gummed surface clean, and press it firmly on the cemented area. Puncture-sealing tubes are repaired only with cold patches.

b. Hot patching, used only for plain tubes, is done with the kit shown in figure 15. Clean the tube and buff it with the scraper as for a cold patch. Then apply the patch and place the tube on the anvil. Fit the separate foot into the foot on the vulcanizer

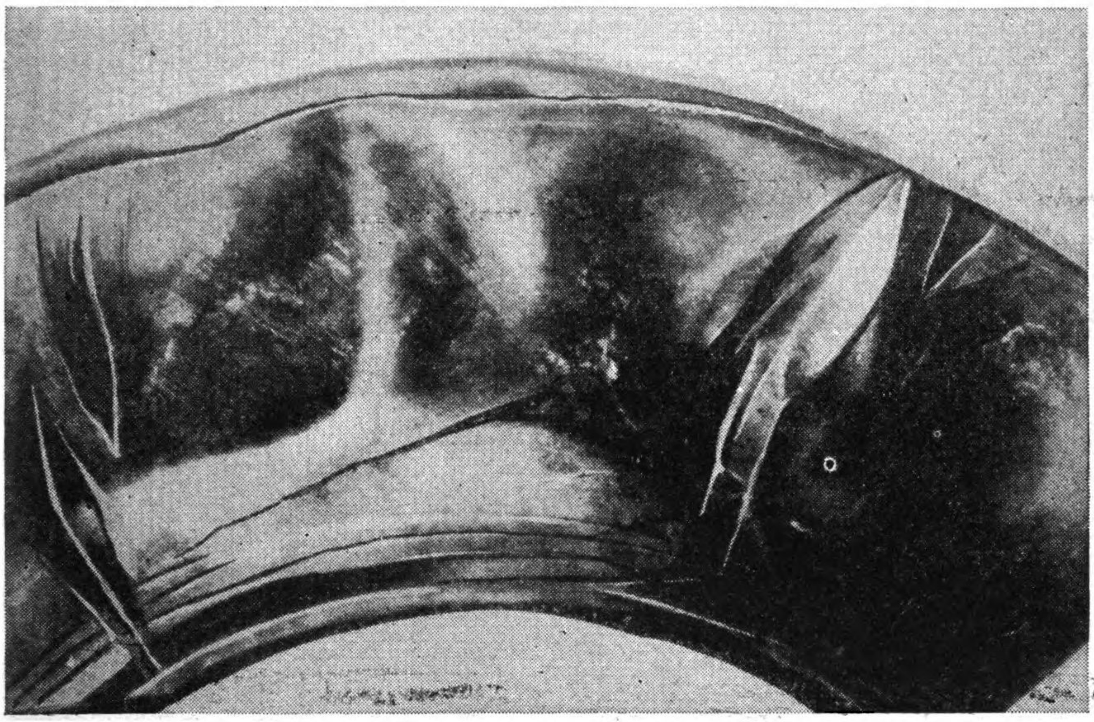


FIGURE 16.—Wrinkled tube.

and center the patch under it. Put the two longer arms in the notch on the patch and tighten the thumbscrew. Nick the heating pad with a sharp tool and light the nicked surface. Allow 10 to 15 minutes for the patch to cure. When the heating unit is cool enough to hold the hand on, remove the tube.

c. Replace broken or damaged valve stems as described in paragraph 75.

17. Fitting tubes and flaps.—Since tubes are of soft rubber, they will chafe unless they fit evenly and smoothly in the inclosure formed by the casing and the rim. Make sure the rim is free from dents and rust, and that the casing is free from cuts, dirt, glass, and metal particles.

a. Put the tube in the casing, with the valve at the balance mark, and inflate it until the beads spread to about the width of the rim. If the tube wrinkles, it is too large for the casing and should not be used. Figure 16 shows a tube that was too large. If it becomes rigid enough to assume its normal shape before pressing against the casing, it is too small and will be stretched.

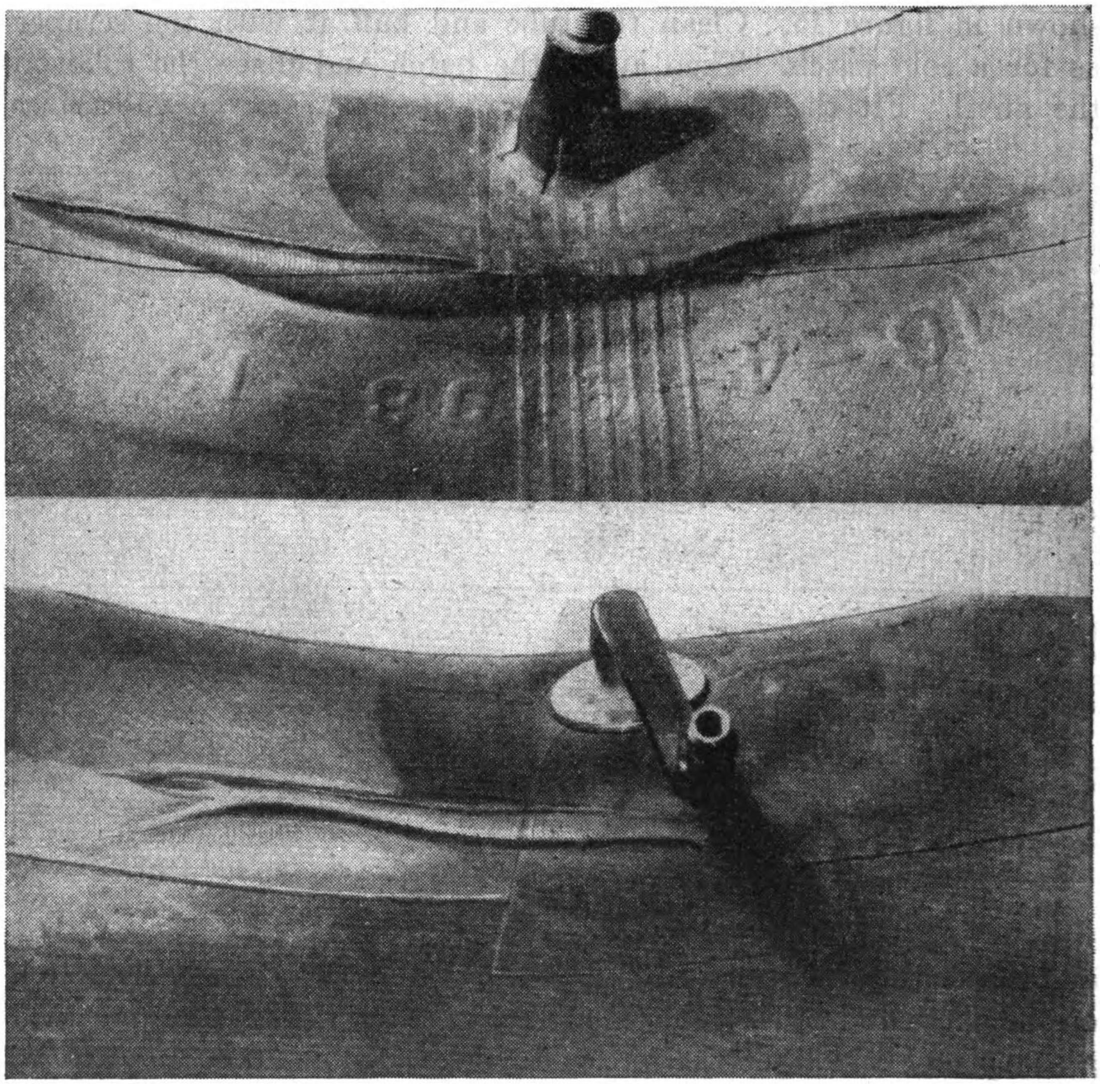


FIGURE 17.—Tubes chafed by wrinkled flap.

b. (1) A flap (fig. 76) is used to protect the tube from the rim. It is always used with a flat base rim, sometimes with a semi-drop center or a drop center rim. It covers the part of the tube not covered by the casing and extends between the tube and the casing. It must be the proper size for the tire.

(2) The flap must fit without wrinkles and must lie smoothly between the casing and the tube. A wrinkle will wear through the

tube (fig. 17). A wrinkled flap cannot be smoothed out satisfactorily; it must be replaced. A flap that is marked with a size smaller than the casing size is difficult to center and may not protect the tube.

18. Storage.—*a.* Plain tubes should be stored in their original packages, which are partly airproof and moistureproof. New or used tubes not in packages should be deflated and folded, then covered to protect them from air, moisture, grease, and oil. Tubes should not be piled so that they will be permanently creased. Tubes should not be stored for more than 2 years.

b. Puncture-sealing tubes should be inflated just enough to keep them round, then stacked, but not high enough to flatten the bottom tube. The tubes must also be protected against air, dirt, moisture, grease, and oil.

Section IV

RIMS

19. Rim.—The rim has three functions: it completes the inclosure for the tube, holds the beads of the casing in place, and connects the tire to the vehicle. Very commonly, the rim and wheel, which is dished, are permanently fastened together as one unit and bolted to the hub (see fig. 20). Otherwise, the rim is attached to a straight spoked wheel with lugs (see fig. 21).

20. Types of rims.—Four types of rims are used: drop-center (fig. 18), semidrop-center and flat-base (fig. 19), and split rims for combat tires (figs. 77 and 78). The essential differences between types are important in dismounting and mounting and in the tire fit.

a. The drop-center rim (fig. 18) is generally permanently fastened to the wheel. Its important characteristics are a well and the taper of the bead seats. Tires mounted on this rim must have a corresponding taper on the bead. Sometimes a band of rubber is placed around the rim in the well to protect the tube. This is called a rim strip.

b. The semidrop-center rim (fig. 19) has a shallow well and a removable flange. It is also permanently fastened to the wheel.

c. The flat-base rim (fig. 19) has flat bead seats and no well. It has a removable flange. Tires used with it must have flat beads.

NOTE.—Two types of removable flanges (lock rings) are used with semidrop-center and three with flat-base rims. These are not interchangeable. For

further details on these removable flanges see paragraph 35. Details of the removing and replacing procedures are covered in section VI.

d. Split rims, an Army development, are specially constructed for combat or run-flat tires A bead lock keeps the tire from coming off when it is completely deflated. Details of its construction, along

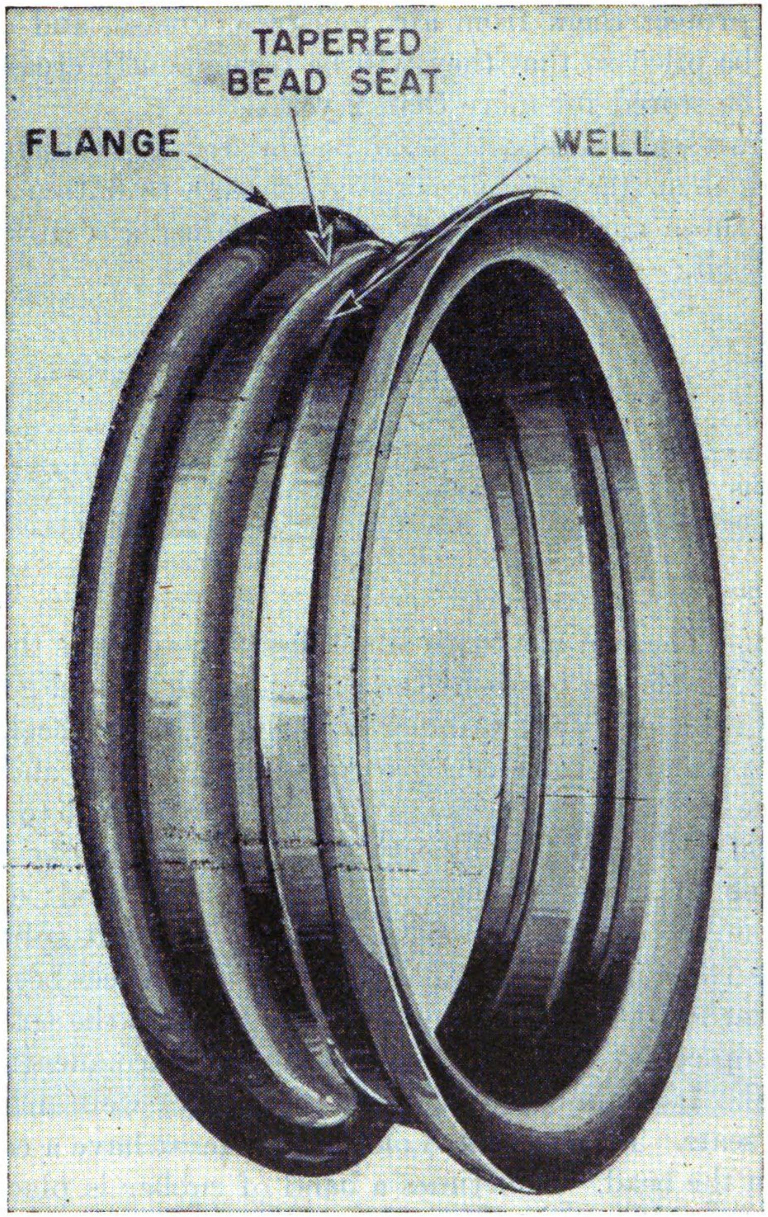
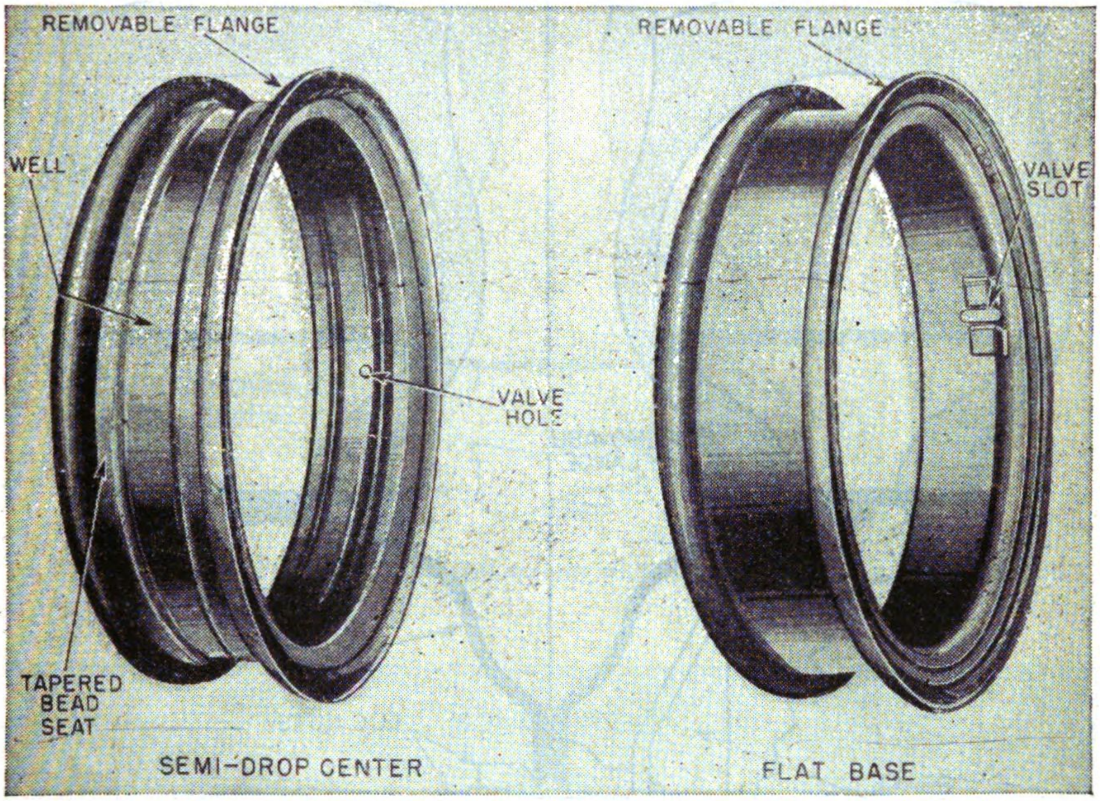


FIGURE 18.—Drop-center rim.

with mounting and dismounting instructions, will be found in chapter 2.

21. Matching rims and casings.—*a.* The rim must match the casing both in type and in size. The diameter of the casing at the bead must be the same as that of the rim.

b. A rim of the wrong diameter will be obviously too large or too small, but a rim that is too wide or too narrow is not so easily recognized. A casing placed on it may appear properly seated. Actually, however, the shape of the casing is changed so that it may pinch the tub or even blow off. The size is marked on all rims, but the marking is often illegible and it is generally easier to measure the actual width between flanges. Appendix I lists the commonly used rim sizes.



① Semi-drop-center rim. ② Flat-base rim.

FIGURE 19.

22. Dual wheel assemblies.—*a.* Wheels mounted as part of dual wheel assemblies are offset, or dished, from the center of the rim to make a space between dual tires (fig. 20). The position of a single tire is determined by the vehicle manufacturer, but the minimum spacing for dual tires has been standardized by the Tire and Rim Association. Appendix I lists the minimum dual spacing for various tire sizes. The spacing listed is the distance from the center of one tire to the center of the other tire, which is twice the offset required for each wheel (fig. 20). If dual tires are spaced less than the recommended distance, the air circulation will be insufficient to cool them. When mounting disk duals, be sure the handhole of the

outside wheel is lined up with the valve stem of the inside wheel to make inflating possible.

b. On wheels with demountable rims (not part of the wheel) (fig. 21), dual spacing is provided by metal spacer bands between the rims.

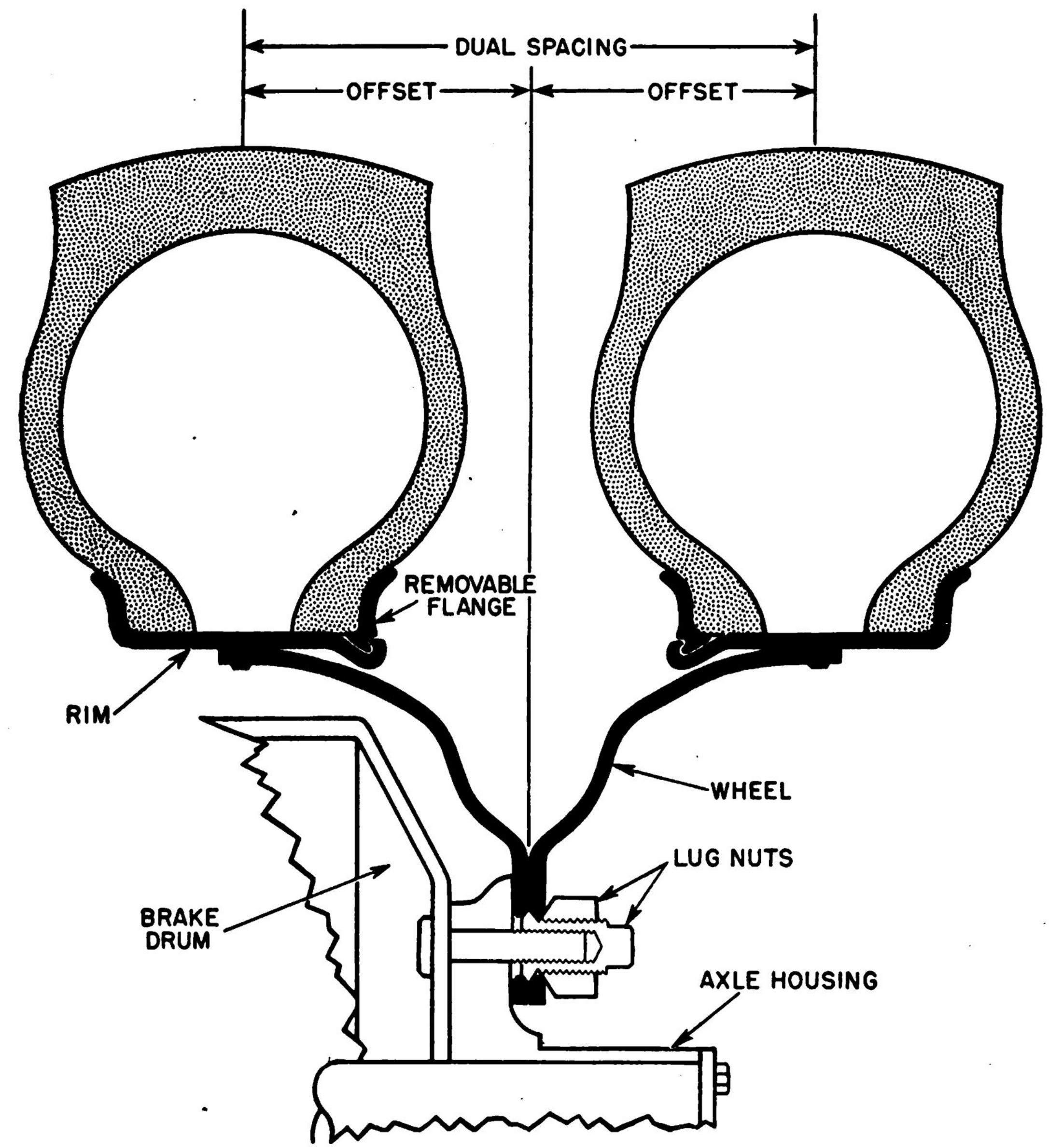


FIGURE 20.—Dual tire spacing with disk wheels.

23. Bolt circle.—The bolt holes (fig. 22) by which disk wheels are mounted are evenly spaced around an imaginary circle, called the bolt circle. There may be 5, 6, or 10 bolts. Obviously, the bolt circle and the number of holes must match the hub.

24. Damaged rims.—*a. Reparable.*—Because the rim is in close contact with the rubber casing and flap, it must be smooth and clean. Rusty, dented, or burred rim flanges cut the tire and may

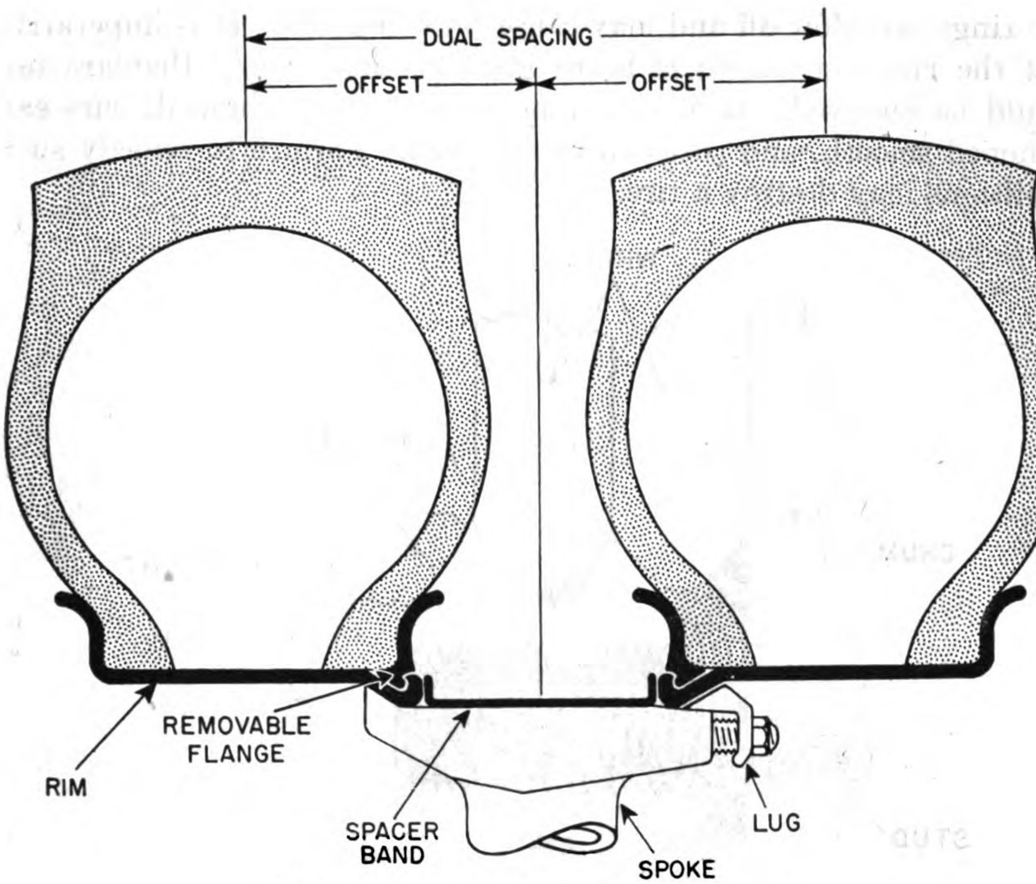


FIGURE 21.—Dual spacing with spacer bands.

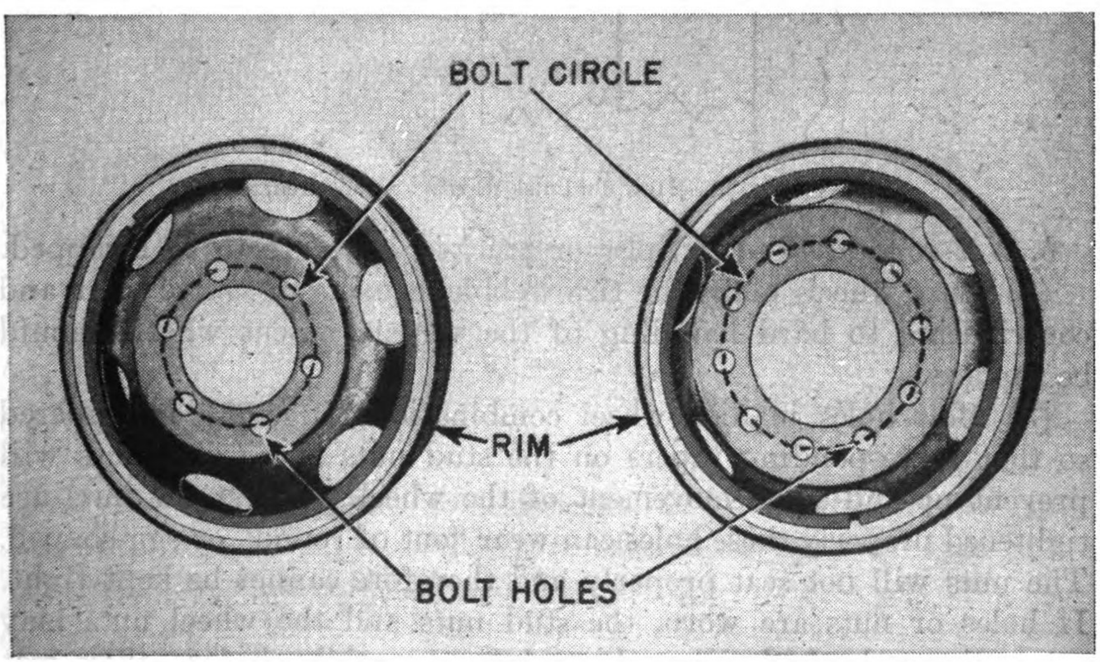


FIGURE 22.—Bolt holes and bolt circles.

cause blow-outs, or allow the tire to blow off. Dented or sprung side rings can blow off and may cause fatal injuries. It is imperative that the rims on a vehicle be in good condition; any that are not should be removed. Bent rim flanges can be straightened, burs can be honed smooth, and rust can be removed. Failure to remedy such conditions may destroy a tire.

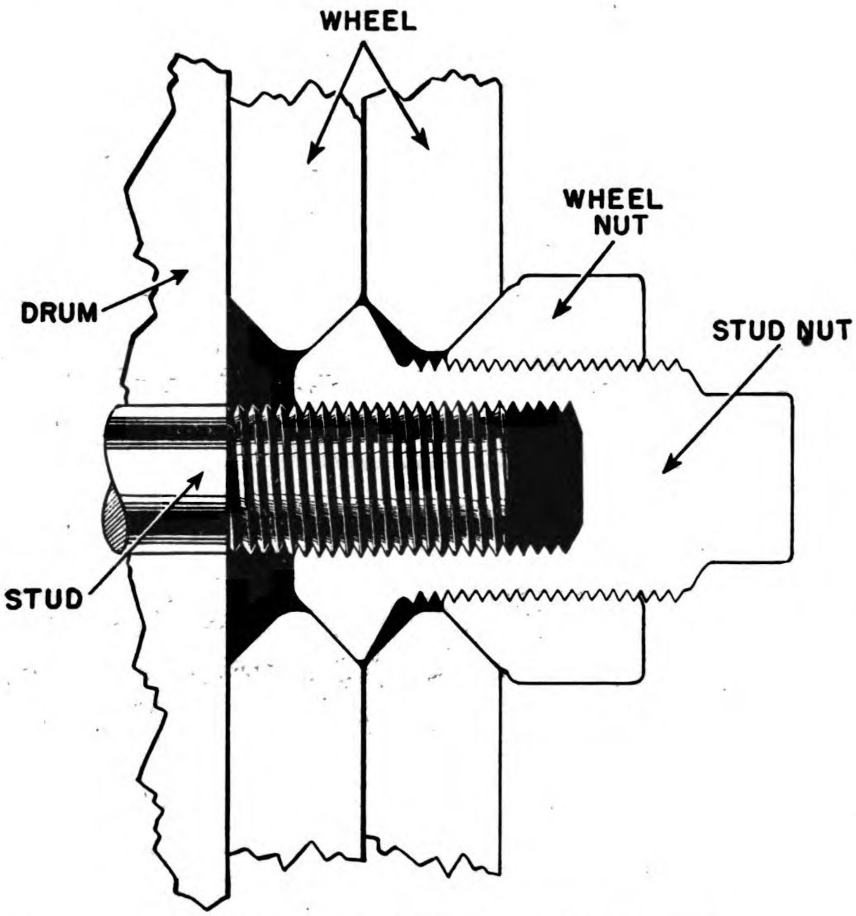


FIGURE 23.—How dual disk wheels are mounted.

b. Not reparable.—(1) Split or cracked rims are to be scrapped.

(2) Bent wheels make the tire wobble, causing excessive wear and contributing to hard handling of the vehicle. Bent wheels should be replaced.

(3) Bolt holes in disk wheel combinations (fig. 23) are tapered so that corresponding tapers on the stud nuts and wheel nuts will prevent up-and-down movement of the wheel. Unless the nuts are tightened properly these holes can wear "out of round" or egg-shaped. The nuts will not seat properly and therefore cannot be kept tight. If holes or nuts are worn, the stud nuts and the wheel nuts may reach the end of the threads and become tight before they seat against the wheel, and the wheel will be loose.

SECTION V

SERVICING

Paragraph

25. General.—Tire servicing means maintaining proper air pressure, removing and repairing damaged or worn casings, tubes, and rims, and mounting the tires so that the maximum life will be realized. Regardless of how well designed or how well built a casing, tube, or rim may be, it cannot give satisfactory performance unless it receives constant care and maintenance.

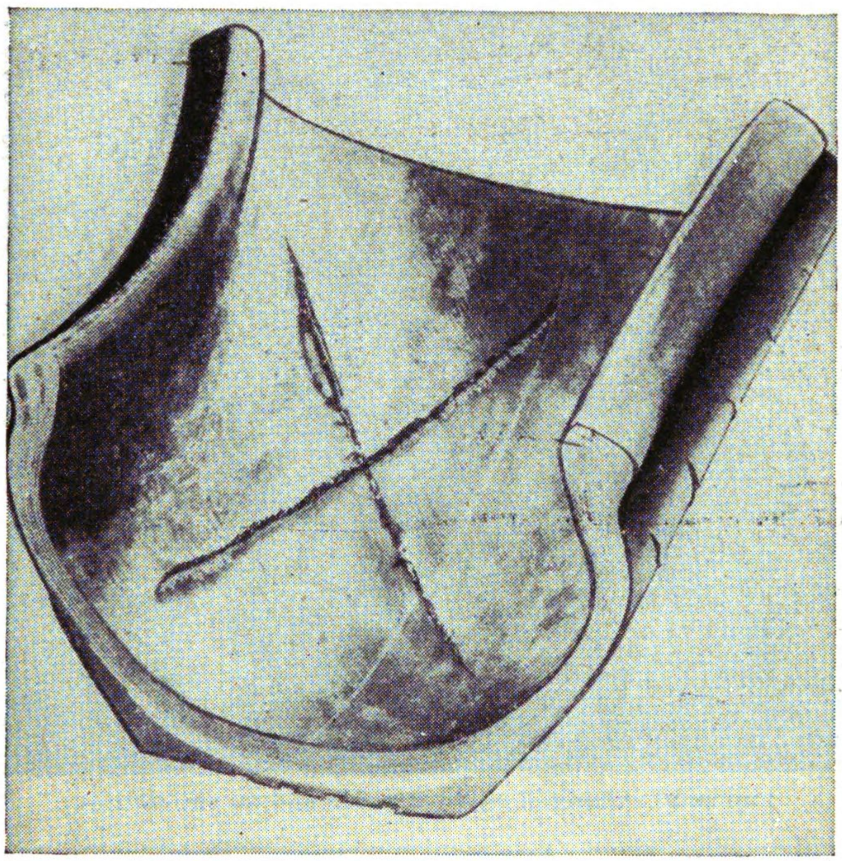


FIGURE 24.—X-break or star rupture in an overinflated tire.

26. Air pressure.—All tires lose air. It is the air alone that supports the vehicle and prevents destructive overflexing of the outer casing (see par. 8). The air which is lost must be replaced.

a. The recommended air pressures for various sizes of tires are tabulated in appendix I. These pressures are based on cool tires. When the tires are warmed from running, the pressures will rise to some figure that cannot be determined beforehand. Don't reduce this correct pressure by bleeding the tires because it results in underinflation and the tire will overheat and blow out. Do not overin-

FIGURE 25.—Effect of improper toe-in and toe-out on tires.

flate cool tires. This reduces the area in contact with the road and results in faster wear (see fig. 24). Overinflated tires are also more easily ruptured and cut when they hit objects in the road.

b. The excessive strains caused by overinflation may cause the bead wires to chafe through the casing. Pressure should be checked daily just before the vehicle is run. If the pressure is less than that recommended, add air. If the pressure is above standard and the

tire is cool, adjust it. Pressure must not be reduced in warm tires. Check the valve for leaks (ch. 4) every time the valve cap is removed, and be sure the valve cap is replaced. Any tube that consistently loses air must be repaired. A flat tire can cause a serious delay. Figures 3 and 9 show what happens to tires that have been run underinflated. These casings are beyond repair and are dangerous, since they will pinch the tube and cause a blow-out.

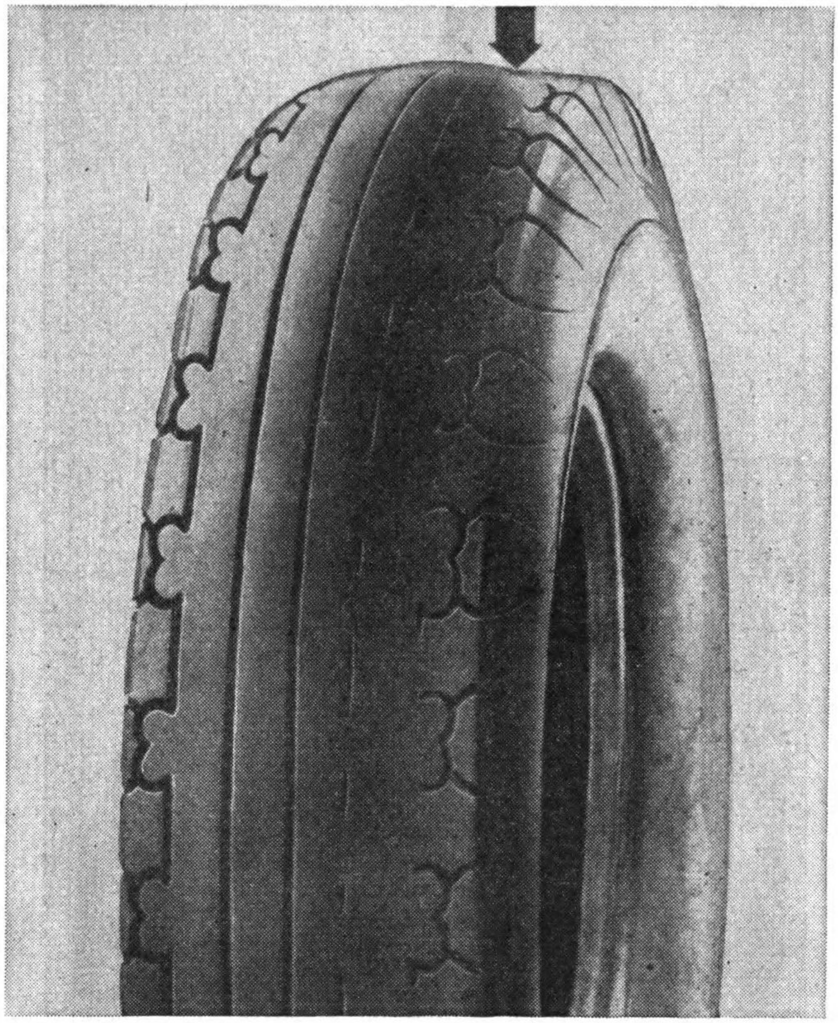


FIGURE 26.—Effect of improper camber on tires.

27. Mechanical irregularities.—Mechanical irregularities in the vehicle, which increase the rate of tire wear, are sometimes indicated by the condition of the tread. Improper toe-in or toe-out (fig. 25), improper camber (fig. 26), improper caster (fig. 27), unbalanced wheels (fig. 28), grabby brake or clutch (fig. 29), severe use of brake and power—any or all of these cause rapid or uneven wear. Make sure the vehicle is in good mechanical condition before mounting the tires.

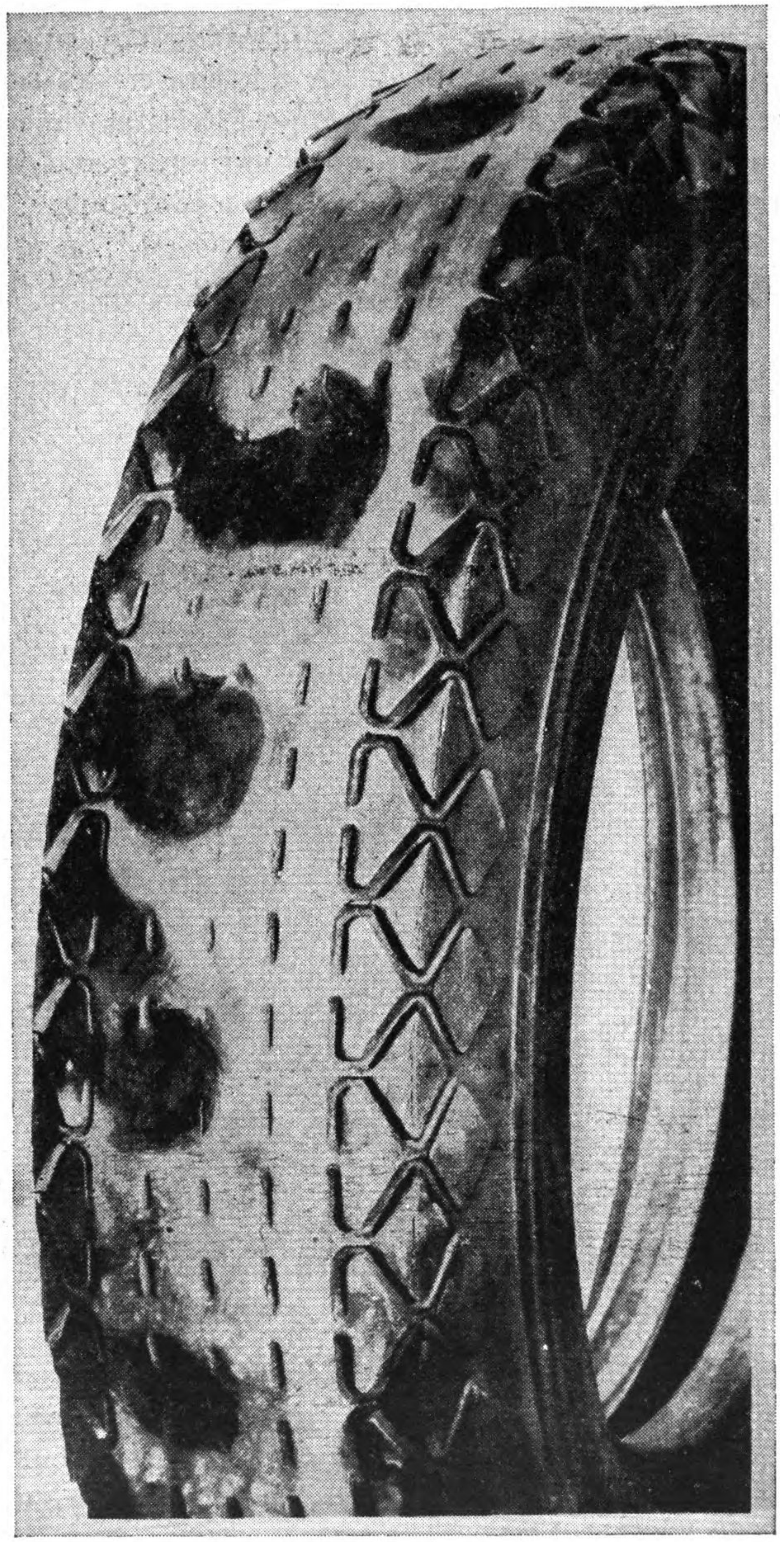


FIGURE 27.—Effect of improper caster on tires.

28. Casing breaks.—*a.* Blow-outs and pinched tubes are often caused by fabric breaks in the casing, improperly fitting tubes or flaps, or bad rims. Make sure the casing, the tube, the rim, and the flap are clean and undamaged; and that they fit properly together after being assembled. A blow-out patch or boot (par. 12*h*) is not

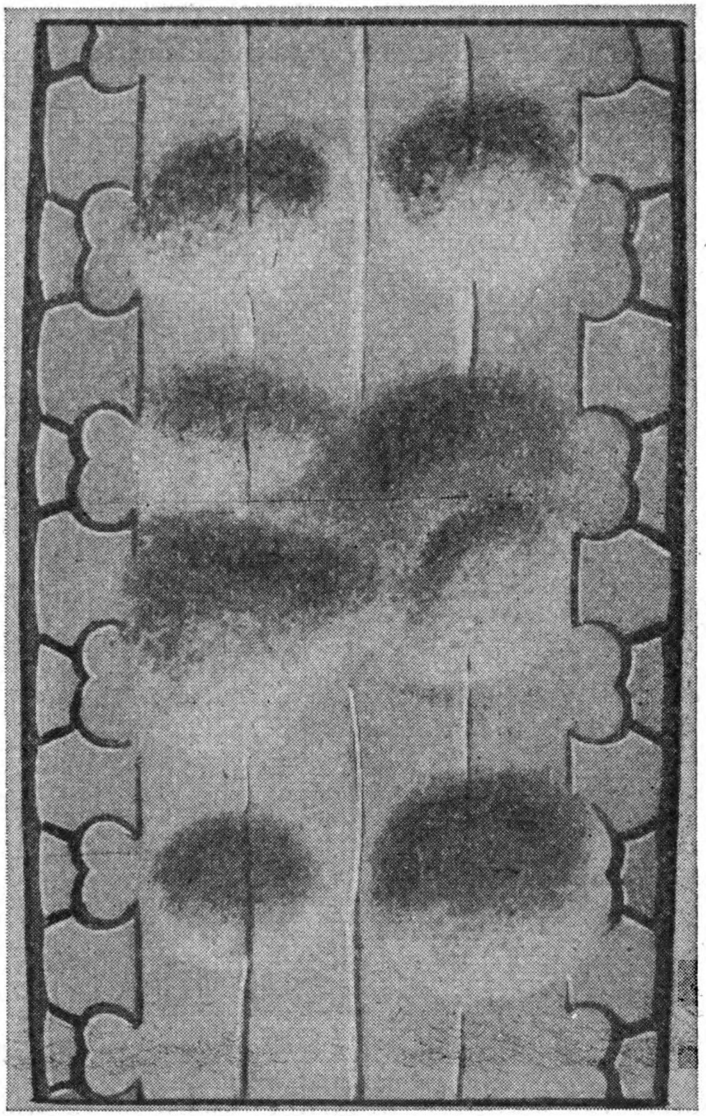


FIGURE 28.—Effect of unbalanced wheels on tires.

a permanent repair, although it may be a valuable temporary repair. Unrepaired cuts may cause a blow-out and probably will destroy the casing, tube, or flap, if continued in service. Worn casings can be recapped or retreaded if removed as soon as the tread design is gone.

b. Smooth or cut tires can cause serious delays and accidents. Remove or repair them before it is too late.

29. Matching duals.—*a. Tire diameters.*—There are two kinds of tire diameters which are generally considered: over-all diameter and loaded or rolling diameter (fig. 30).

(1) Over-all diameter depends on the size of the tire and the amount of tread wear.

(2) Loaded or rolling diameter depends on the size of the tire, the amount of load on the tire, the inflation pressure, and the amount of tread wear. It is an extremely bad practice to try and equalize

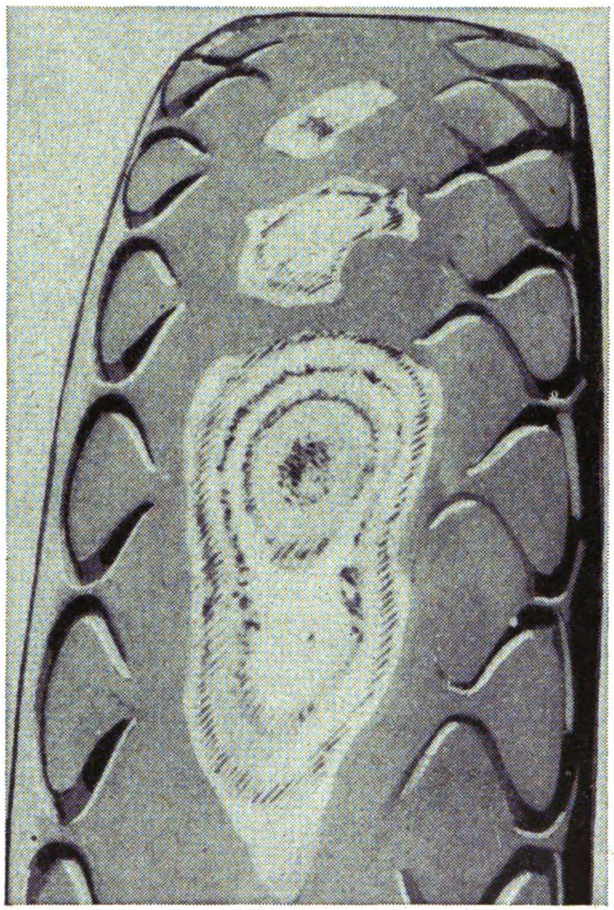


FIGURE 29.—Effect of grabby brake or clutch on tires.

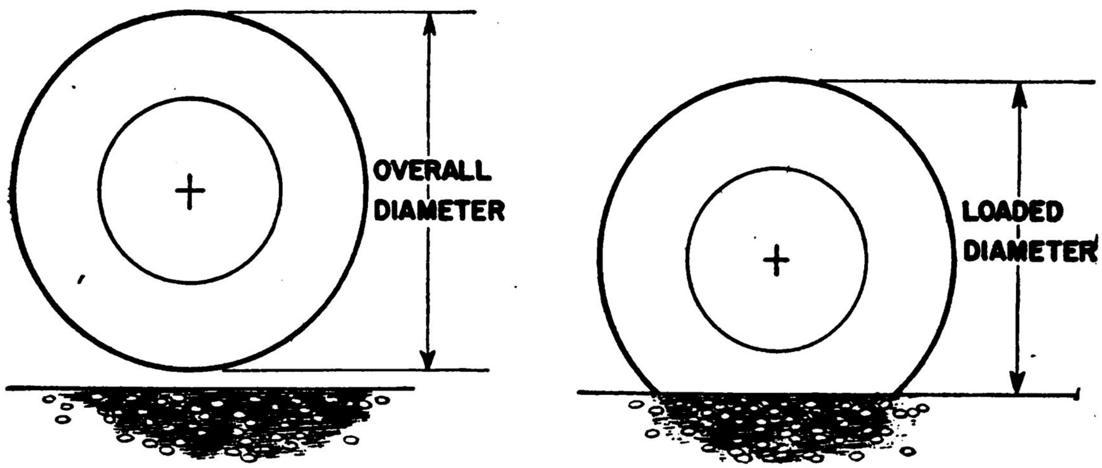
rolling diameters by changing inflation pressures to compensate for overloads or unequal tread wear.

(3) These two tire diameters are of vital importance to tire life, as shown below.

b. Wheels.—(1) Wheels on all-wheel drive vehicles rotate at the same speed when all axles are driving, and of course dual wheel assemblies rotate at the same speed because they are locked together. This means that the loaded diameter of the tires on all driving wheels must be equal so they will carry nearly equal loads and revolve at the same speed without dragging any of the tires along the road.

(2) To obtain maximum service, tires with too great a difference in over-all diameter should not be mated. For 7.50 and smaller sizes, this difference should not be more than ¼ inch and for larger sizes not more than ½ inch.

(3) Vehicle or road characteristics may cause tires to wear unequally. For this reason, if it is not possible to replace a damaged tire with a new tire of the same over-all diameter, select a tire of the nearest equal diameter. Place the more worn replacement tire where the small tire was originally running. Never put a new tire on the inside dual position unless it is matched with a new one.



① Tire off ground—no load. ② Tire on ground—carrying load.

FIGURE 30.—Tire diameters.

c. Pressures.—Dual tires should be inflated to the pressure recommended for their size, as listed in appendix I, when cold. Never adjust the pressure in a tire that is hot, and never match the pressure in hot duals.

d. Dual spacing.—Duals too close together allow insufficient air space for proper cooling and may touch at the bottom when going over bumps. See appendix I for spacing requirements.

e. Multidrive.—(1) A differential permits the wheels attached to a live or driving axle to rotate at slightly different speeds on turns. It should not operate continuously, however. Therefore, unless the left and right tires have approximately the same loaded diameter, the differential will be overworked and may be seriously damaged.

(2) *When operating on dry pavement, front-wheel drive units should be disengaged.*

30. Rotating tires.—The tires wear at different rates and in different patterns, because of different loads, power and brake applications, and steering. Rotating the tires from wheel to wheel, and

changing a vehicle's spare regularly, equalizes the wear and increases the life. However, because of the difference in operating conditions, no strict procedure can be established.

31. Inspection.—*a.* At every opportunity, check the tires for air pressure and look for glass, nails, stones, and other material stuck in the tread or between duals. Unless removed completely, such foreign matter will be imbedded deeper, damaging the casing, and

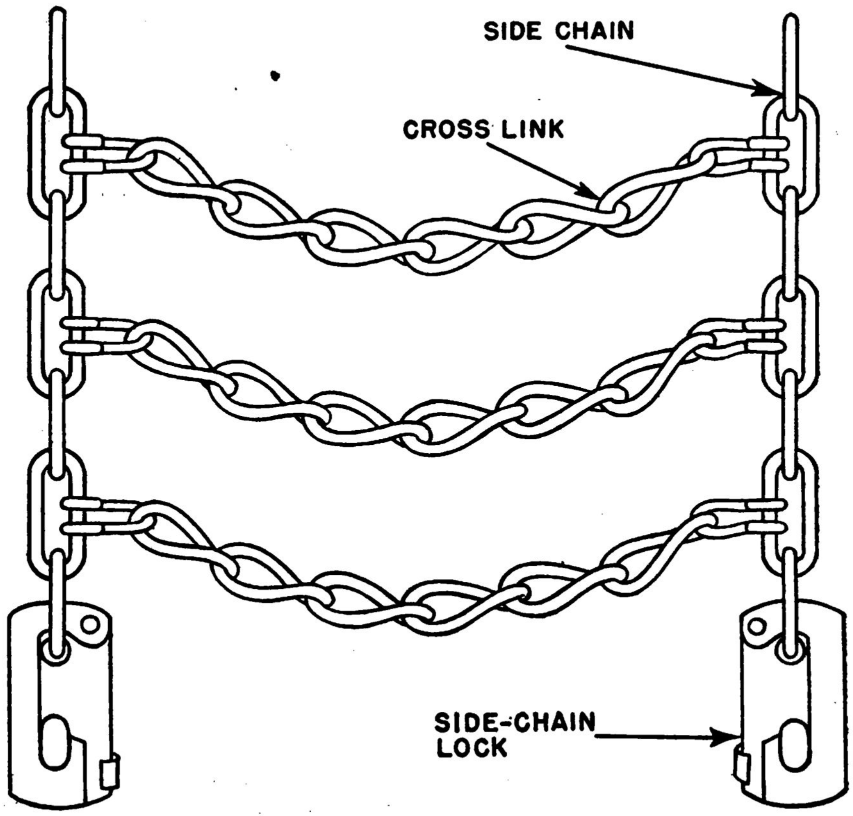


FIGURE 31.—Side chains and cross links.

may eventually puncture the tube. Immediately repair tires with cuts that extend into the breaker. Inspect the sidewalls for wear and breaks. Sidewall wear between duals indicates that they are too close together. Other sidewall wear may be caused by rubbing against curbs, rocks, etc. If the rubber is worn off the sidewalls, exposing the plies, remove the tire for repair. Rims with dents, burs, or bends that may cut the casing or let it blow off must be repaired.

b. Check the tires for the amount of wear and evidence of irregular wear. A mechanical fault may be indicated. Remove tires with bulges and any with the tread worn off. Check the matching of duals and multidrives and the direction in which directional tires are mounted.

32. Chains.—Chains are sometimes necessary to provide extra traction. Not intended for continuous use, they should be used only when necessary and removed as soon as possible.

a. Single chains fit one tire, and dual chains fit both tires of a dual. They are made up of side chains and cross links (fig. 31). Side chain locks connect the side chains. The cross links are flat on one side to decrease tire damage, and may be sharp on the other

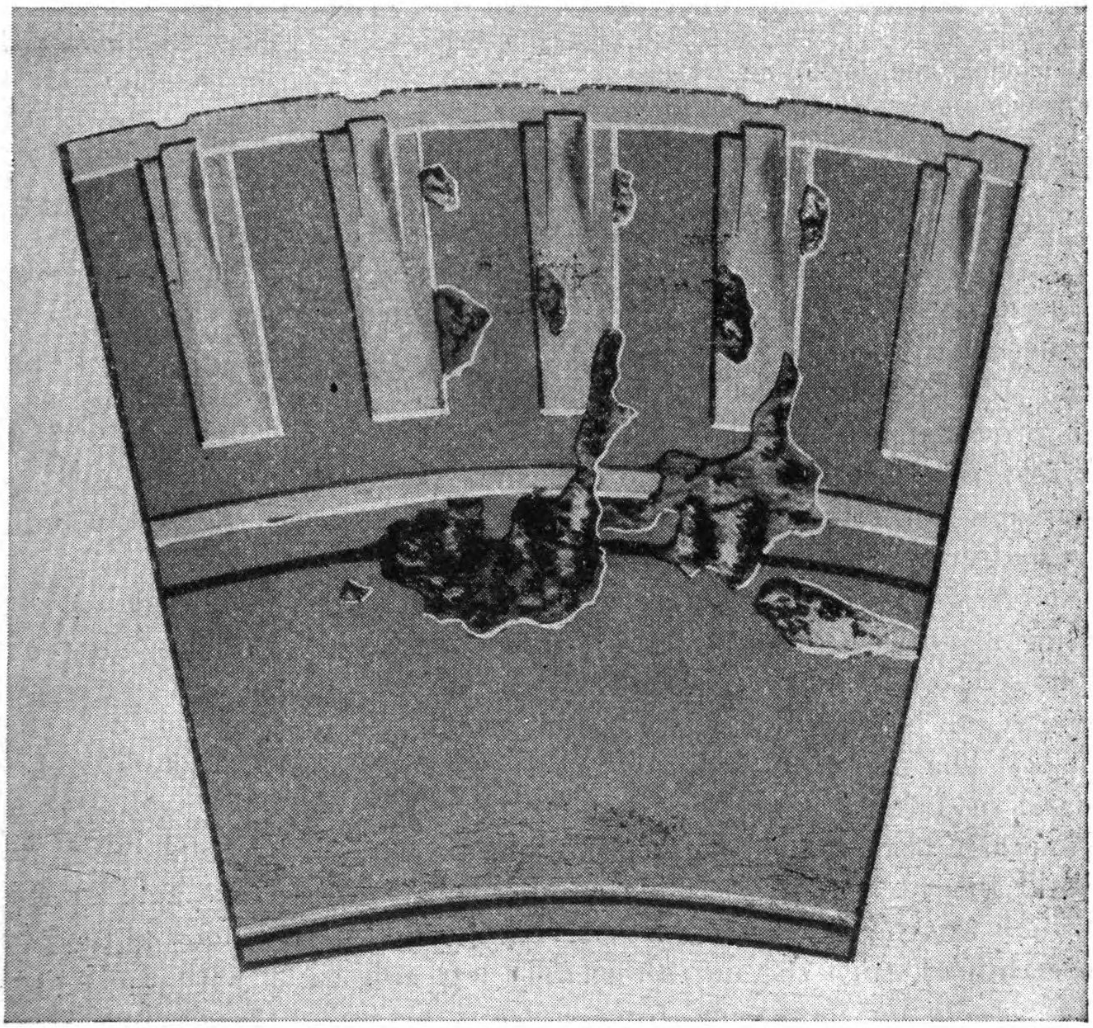


FIGURE 32.—Effect of poorly adjusted chains on casing.

to provide traction. Damaged cross links can be repaired or replaced. Defective side chains and side chain locks must be replaced.

b. Chains must be properly fitted and installed to prevent cutting the tires (see fig. 32). They must be loose enough to creep on the tire and tight enough so that they will not strike the body or be pulled off. The cross links must be of the proper length, so that the side chain is just below the shoulder, and not in contact with the sidewall or the tread.

c. Use chains of the proper size, put them on right side up, and remove them as soon as they are no longer needed. Before they are stored, chains should be washed and dried, worn or broken links replaced or repaired, and oiled to prevent rusting.

d. When using chains, do not reduce the air pressure in the tires.

Section VI

MOUNTING AND DISMOUNTING TIRES

33. Removing and installing wheel.—*a. Jacking.*—When jacking up a vehicle, make sure the jack is seated solidly on a firm, level foundation. Build a base for it if necessary. Block the wheels to prevent rolling. The brakes will not always hold a vehicle. Place the jack directly under the spring pad, unless a special jacking pad is provided. When the vehicle has been elevated sufficiently, put safety blocks under the axle. Serious personal injury as well as damage to the brake shield and drum, may result if the jack should fall after the wheel is removed.

b. Removing mounting nuts.—Single wheels are mounted with 5, 6, or 10 nuts, lugs, or cap screws. On most large vehicles, they are exposed; on passenger cars, they are usually under the hub caps, which can be pried off with a screw driver.

(1) The mounting nuts, or cap screws, may have either a right-hand or left-hand thread. On large vehicles, the left wheel nuts generally have a left-hand thread and the right wheel nuts a right-hand thread. The directions of all the threads on one side of the vehicle are the same. If the direction of the thread cannot be readily ascertained, turn the nut alternately left and right with the wheel wrench, using increasing force until it loosens. If possible, keep the brakes set while loosening the nuts. If this is not possible, loosen the nuts one turn before jacking the wheel clear. However, don't remove nuts or studs with the wheel on the ground. The weight of the vehicle will bind or strip the threads.

(2) Rims attached with nuts are easily removed. If the rim is attached with lugs, tap the lugs loose and remove them. Then jar the rim until it can be removed.

c. Dual wheels.—Dual wheels may be mounted as shown in figure 23. The inner wheel is held in place by the stud nuts, and the outer

wheel is held in place by wheel nuts. The stud nuts may be loose, even though the wheel nuts are tight. Loose stud nuts permit the wheels to rock on the studs eventually, wearing the threads away. This may cause both wheels to come off. The nuts holding the outside wheel must be loosened before the inside wheel can be tightened.

(1) To dismount demountable rims, remove the lugs (fig. 21), then slip off the outer rim, the spacer band, and the inner rim.

(2) Wheels or rims must be lifted to clear the studs. This can be done with a pry such as the lug wrench handle.

d. Replacing wheels.—(1) Clean the contacting surfaces of the rim or wheel and the hubs so that the wheel will run true. Replace wheels attached by studs or nuts by reversing the order of removal. Always make sure the studs for duals are tight before tightening the nuts.

(2) Rims mounted with lugs fit on tapers (fig. 21). Apply the rim and the spacer band, if used, and then push the lugs on by hand, centering the rim on the wheel. Tighten the lug nuts one turn at a time. Tighten first one nut and then the nut opposite it, not one nut after another around the rim. Make certain the wheel runs true.

34. Casings on drop-center rims.—These rims (fig. 18) are used on passenger cars, motorcycles, and some light trucks.

a. To dismount tire.—The tire may be dismounted more conveniently without removing the wheel from the vehicle when the procedure is fully understood.

(1) Remove the valve cap and valve core, completely deflating the tube.

(2) Loosen both beads from the rim flanges (figs. 33 and 34).

(3) Use a soap solution on the outside bead and the rim to make dismounting easier.

NOTE.—Some drop-center rims have a hump over which the beads must be forced when removing the casing. Use the special tools supplied with the vehicle and follow the instructions to avoid damaging the beads.

(4) Turn the wheel so the valve is at the top, insert a tire iron between the outer bead and the rim, near the valve (fig. 35). Two irons placed about 6 inches apart may be used.

(5) Pry the outer bead over the flange, while pushing the lower part of the bead into the well (fig. 35).

(6) Work around the tire with the tools, and remove the remainder of the bead.

(7) Reach inside the casing and remove the tube, starting at the bottom.

(8) Let the inner bead drop into the well, grip the outer bead at the bottom, and pull it straight out until the casing swings free.

FIGURE 33.—Loosening outer bead with tire tool.

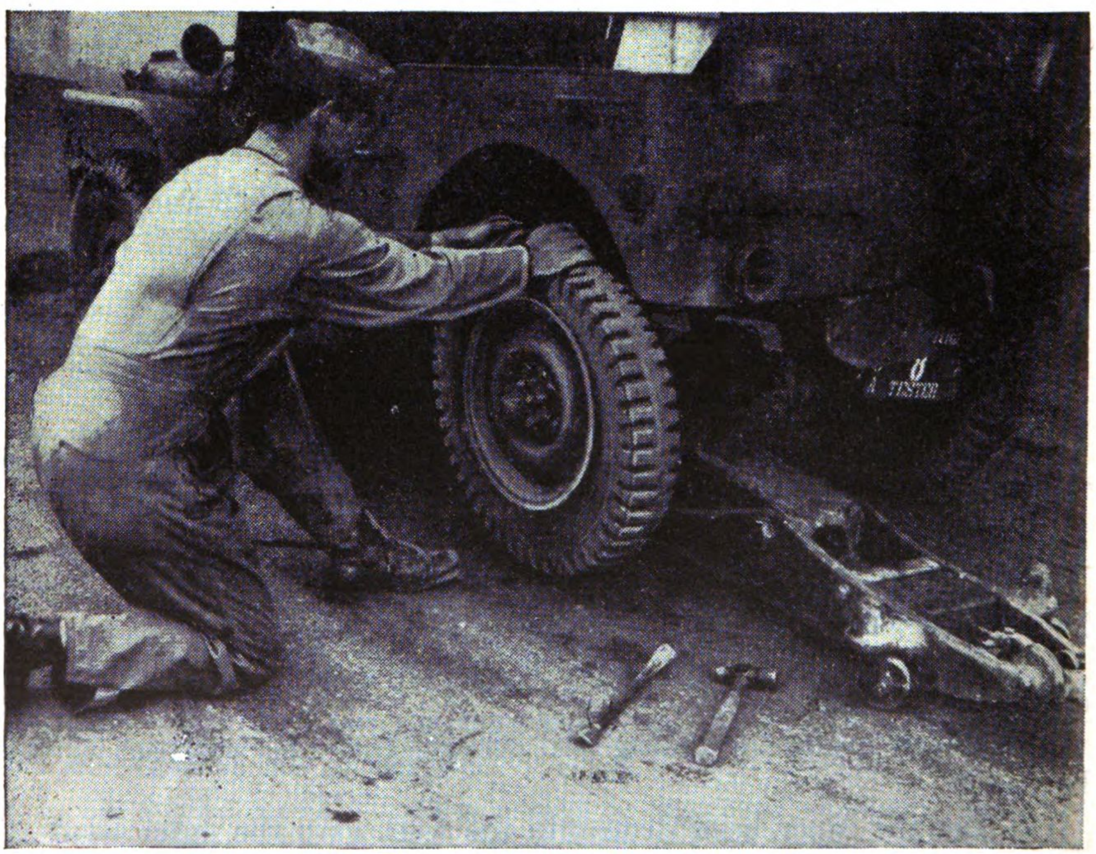


FIGURE 34.—Loosening inner bead by pulling on casing.

b. To mount tire.—(1) Make sure directional treads are applied in the proper direction (see par. 9*b*). Carefully inspect the casing for cuts and breaks. Remove any dust, dirt, paper, etc., found inside. This foreign material will chafe through the tube (fig. 36). Make sure the rim is clean and free from dents. Mount it on the vehicle with the valve hole at the top. Make sure the tube is the

FIGURE 35.—Prying outside bead over rim.

correct size for the casing and that the rim strip, if used, is in good condition.

(2) Inflate the tube until it begins to fill out. Then insert it in the casing, placing the valve at the red balance mark.

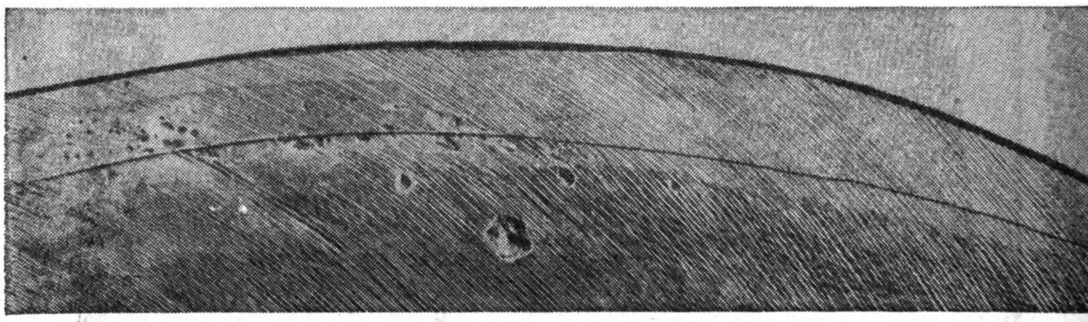
(3) Apply part of the inside bead with the valve through valve hole.

(4) Push part of the inside bead down into the well and force the remainder of the bead over the rim flange (fig. 37). It may be

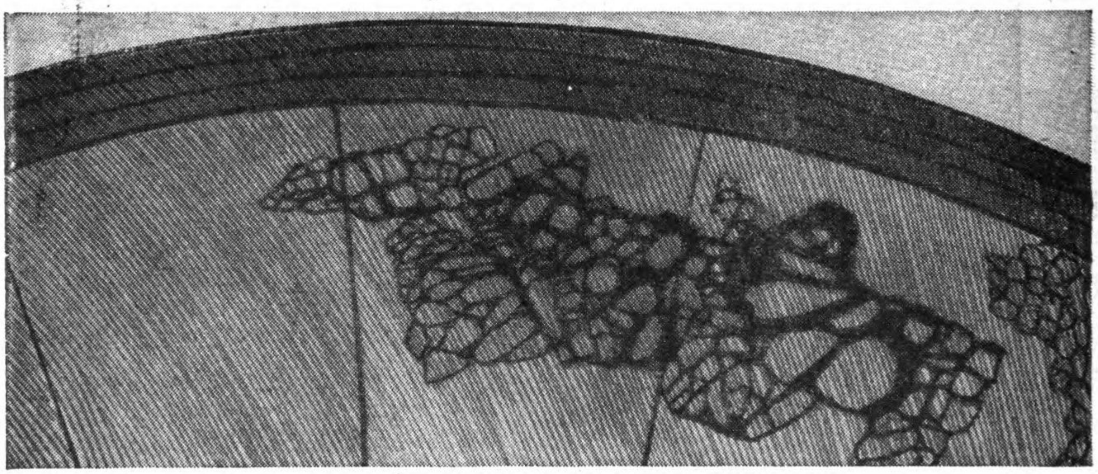
necessary to use a hammer to drive the last portion of the bead over the flange.

(5) Turn the wheel so that the valve hole is at the bottom. Then place the top part of the outside bead in the well and work the bead over the rim with the tire tool, working around the rim until the bead is in place. While mounting, keep as much of the bead in the well as possible (fig. 38).

(6) Make sure the valve is straight in the hole, sliding the casing around the rim if necessary.



① Dirt in casing.



② Paper in casing.

FIGURE 36.—Chafed tubes.

(7) Inflate the tube slowly until the beads of the casing are forced out tightly against the rim flanges. If the bead is not seated against the rim flange, the bead is not seated properly on the tapered bead seat (fig. 18). This may be caused by insufficient pressure in the tube or a bent rim. If the bead is not properly seated on the tapered bead seat, the tube will be pinched between the bead and the rim and chafed through.

(8) Completely deflate the tube to relieve the pressure on any folds or buckles and allow the tube to assume its proper contour in the casing.

(9) Inflate to recommended pressure; then check the valve for leaks (par. 77), and install the valve cap by hand. Using a tool may damage the cap.

35. Casings on semidrop-center rims.—Semidrop-center rims (fig. 19) are used on the ½-ton chassis. These rims, which are similar in outward appearance to flat-base rims, may be distinguished by the *shallow* well in the center.

FIGURE 37.—Forcing inside bead over rim.

a. To dismount tire.—(1) Remove the wheel.

(2) Remove the valve cap and valve core, completely deflating the tube.

(3) Place the wheel (removable flange) on three or four wood blocks (2 by 4 blocks, 3 or 4 inches long) to keep the tire off the ground.

(4) Loosen both beads from their seat in the rim with the tools shown in figure 39. Drive the flat end of the straight tire iron between the bead and the rim flanges, the smooth side of the iron next to the tire, as in figure 40. Hold the iron down on the sidewall to avoid cutting the bead and make sure the iron is driven in until it

strikes the rim. While holding the straight iron in place, insert the forked end of the other iron so that the serrations or gears will mesh with the serrations or gears on the straight iron, as shown in figure 41.

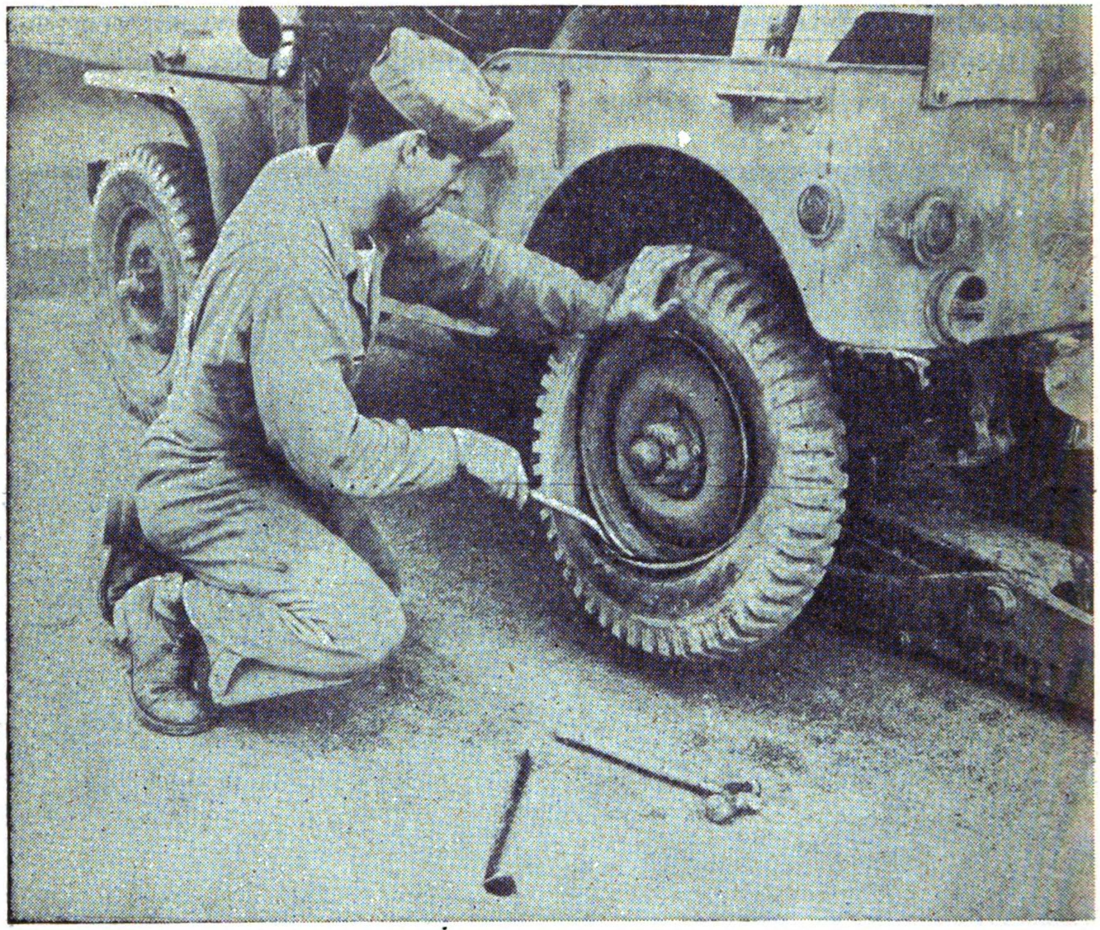


FIGURE 38.—Mounting outside bead over rim.

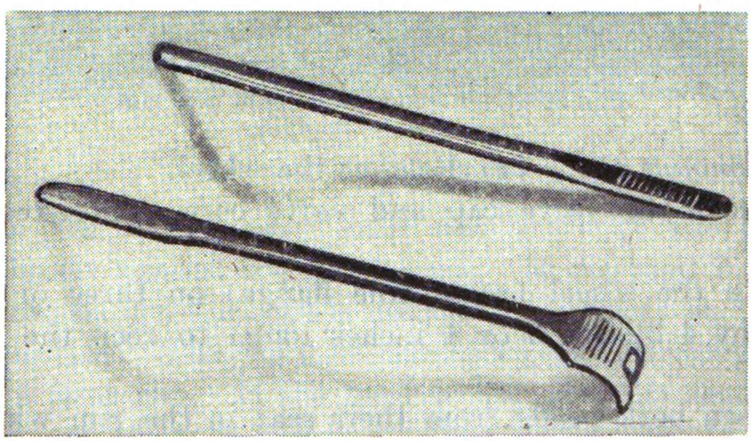


FIGURE 39.—Bead loosening tools.

Draw the handle of the forked iron down toward the tire, while holding the straight iron firmly against the sidewall. This will break the bead loose (fig. 42).

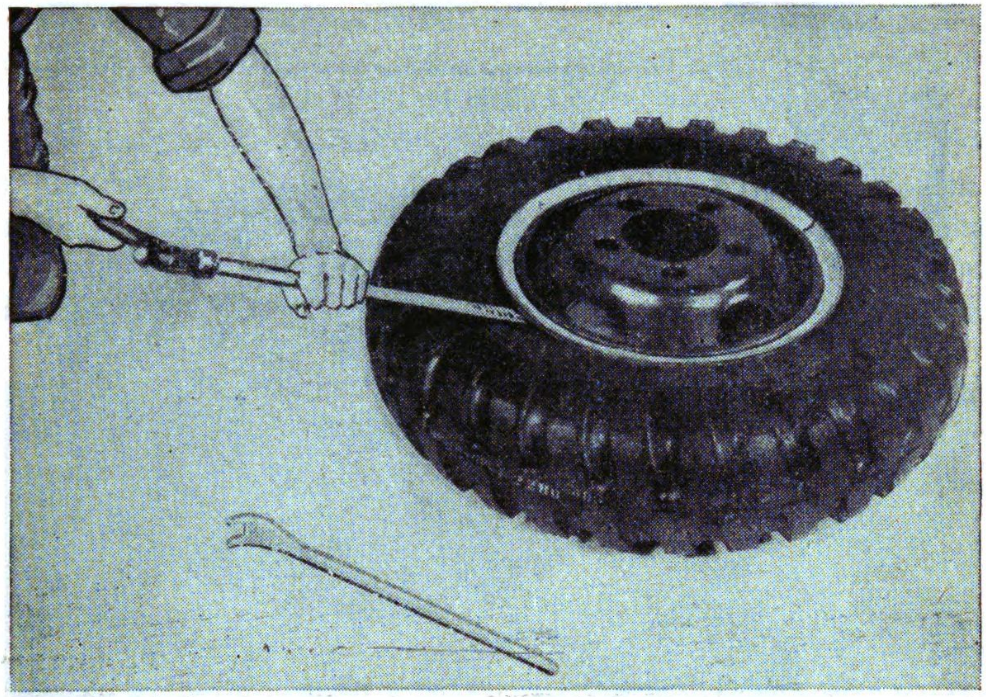


FIGURE 40.—Driving in tools.

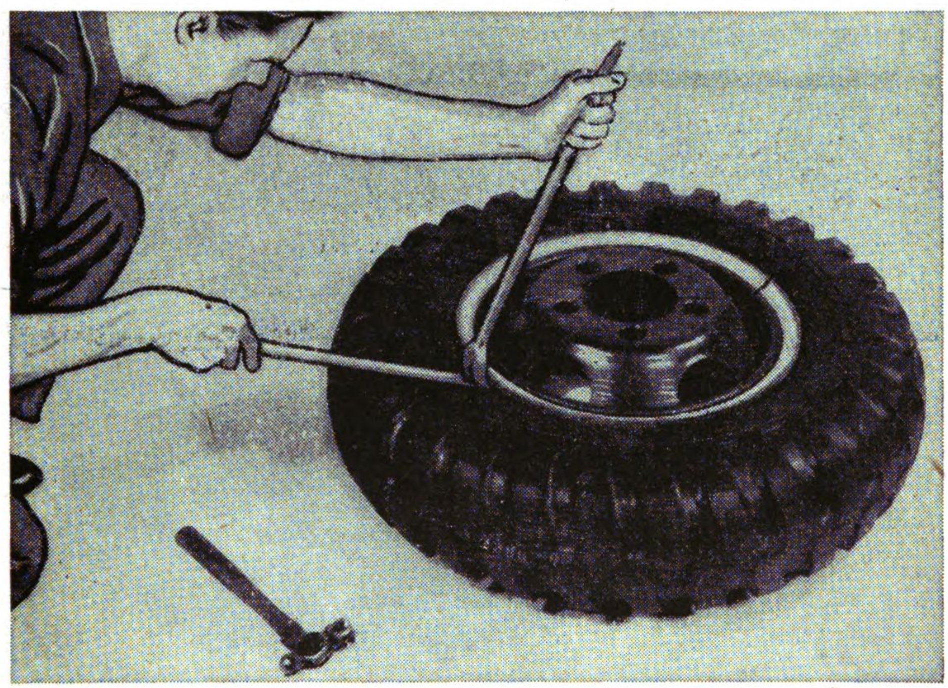


FIGURE 41.—Meshing tool.

(5) The bead may also be loosened from its seat by driving a tire iron between the removable flange and the tire bead. Pry the tire loose by forcing the iron toward the tread. The tire iron can also be held against the side of the tire and the iron hammered with a medium weight hammer, just above the removable flange.

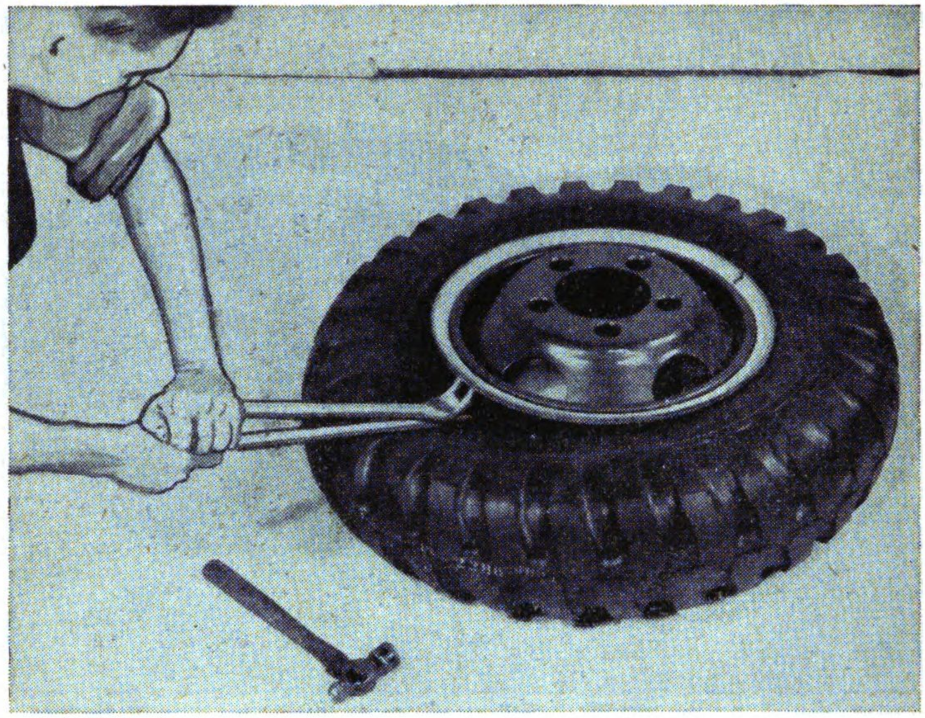


FIGURE 42.—Loosening bead.

FIGURE 43.—Loosening bead with wedge.

(6) A third method of loosening the bead is to use a wide, flat, blunt wedge (fig. 43). The wedge should be held as close as possible to the sidewall of the tire to prevent damaging the bead.

(7) Remove the removable flange.

(*a*) *Split ring removable flange.*—Figure 44 shows a cross section of the rim, a split ring removable flange in place, and how the ring is locked in after the bead is broken loose. Force the removable flange down far enough to unlock it. Then, with the tool entered into the breaking notch, pry the ring out over the rim flange, as shown in figure 45. To avoid twisting the ring, pry only enough to clear the rim flange. Twisted rings make reinstallation difficult and dangerous. Follow

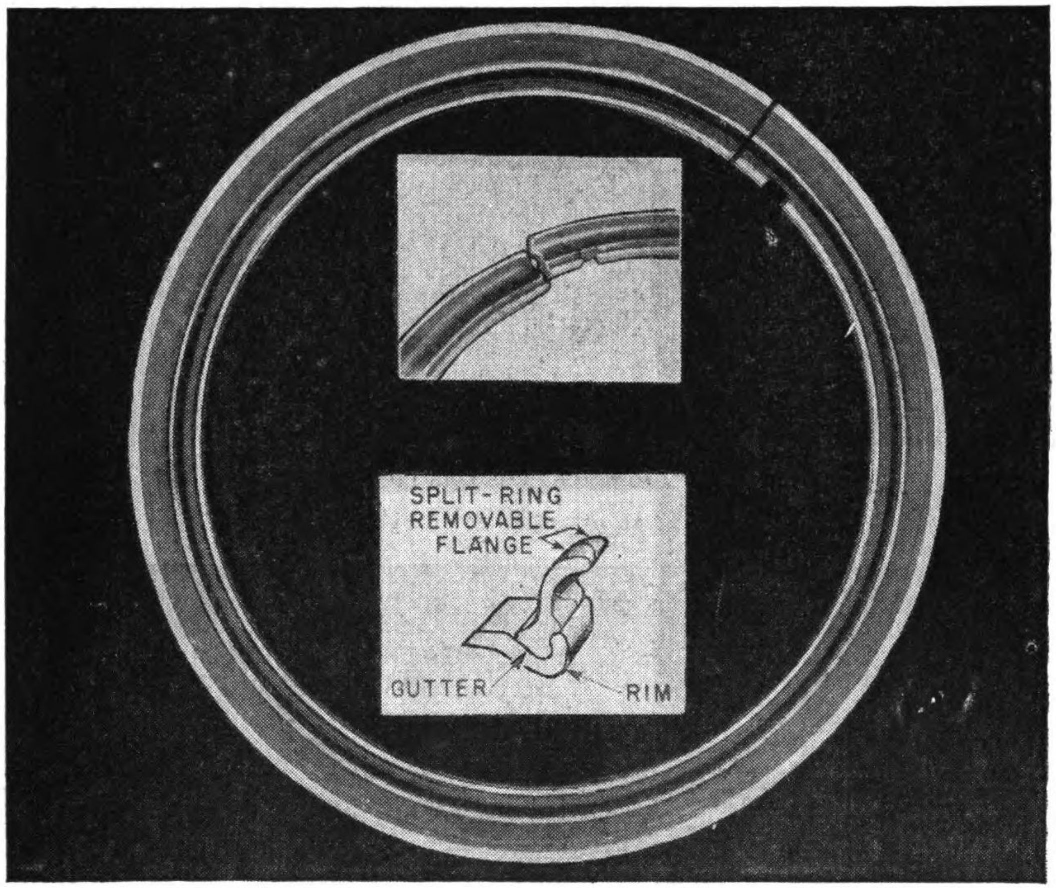


FIGURE 44.—Split removable flange showing how it is locked in.

around with a tire iron if necessary (fig. 46) until the ring can be lifted off.

(*b*) *Continuous ring removable flange.*—Figure 47 shows this rim and how it is locked in. Insert the tool in the square notch (fig. 48). Force the side opposite the square notch into the rim gutter and pry out and up. Two crescent-shaped notches (fig. 47) make removal possible. When pried up to clear the crescent notches (fig. 49) and tapped with a hammer on the outside edge near the square notch, the ring can be lifted off.

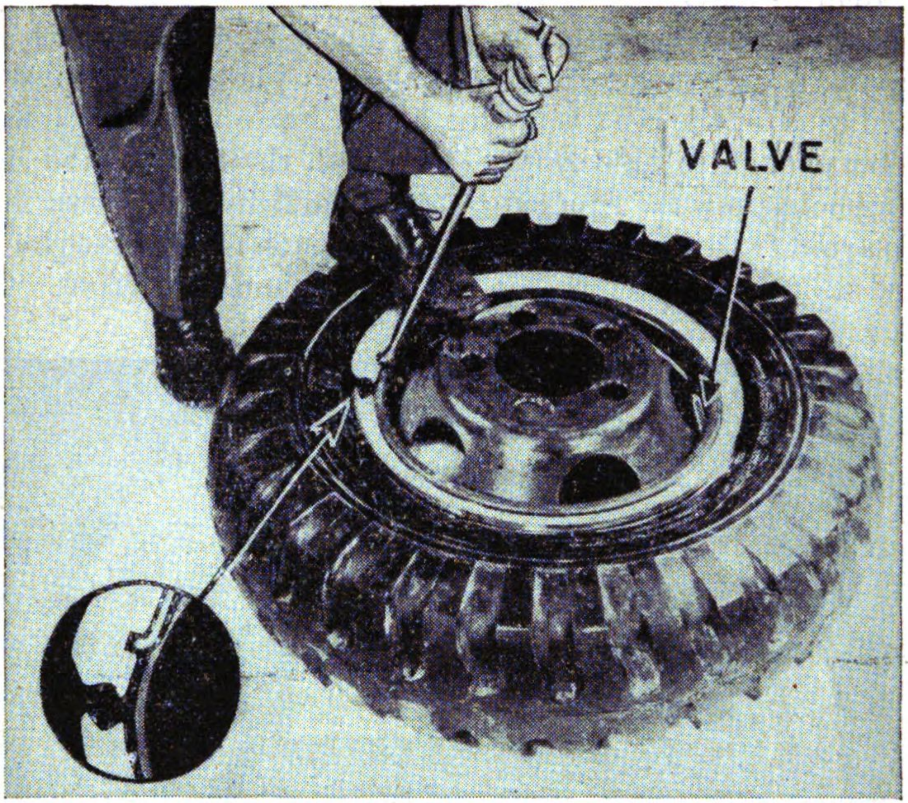


FIGURE 45.—Unlocking split ring removable flange.

FIGURE 46.—Removing split ring removable flange.

(8) After the bead has been broken loose and the removable flange removed, hold the bead down and lubricate the top of the bead and the rim with soapy water (fig. 50). A bar of soap rubbed around the bead and the rim will do the job, but not as well.

(9) Remove the casing. Force a portion of the outside bead opposite the valve into the well (fig. 51). Insert the tire iron under the bead, near the valve, then pry the bead up and over the edge of the rim (fig. 51) while holding the opposite side in the well. Proceed around the tire until the bead is off the rim.

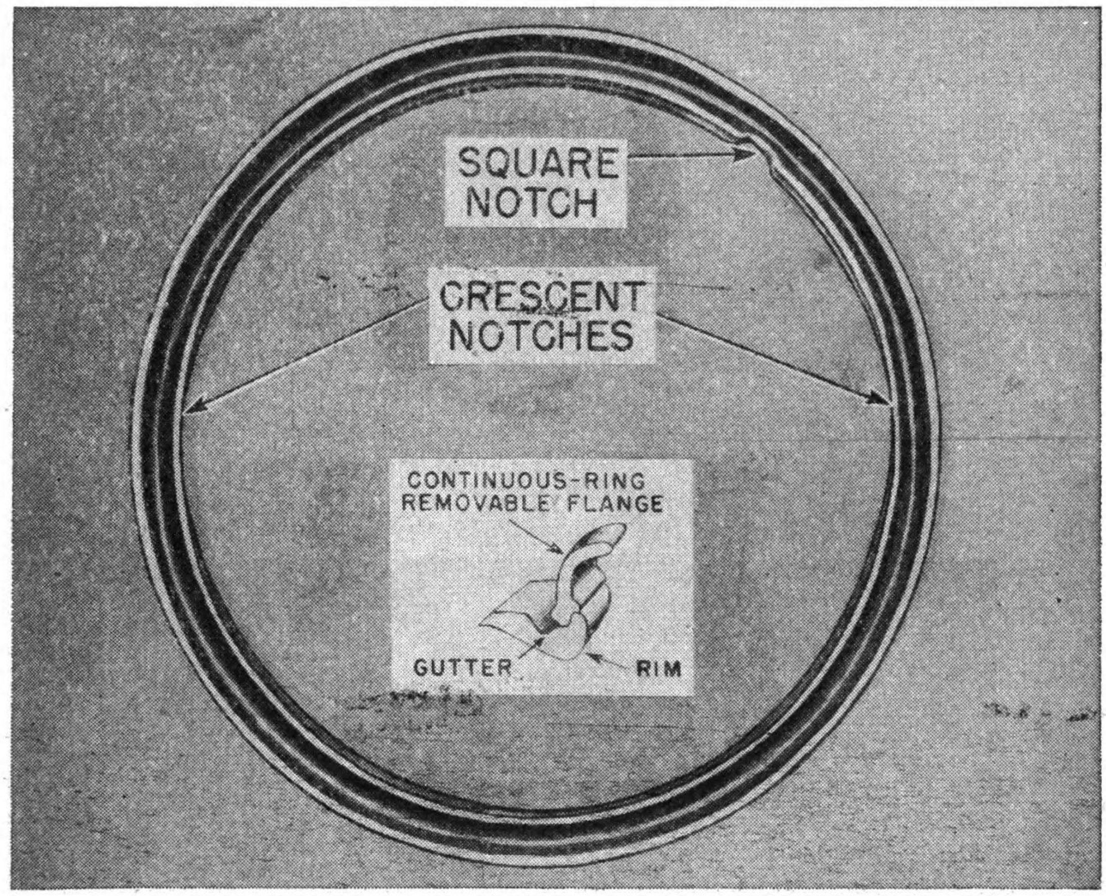


FIGURE 47.—Continuous ring removable flange.

(*a*) Remove the part of the flap and tube opposite the valve, and push the valve through the hole in the rim. Then reach in, lift the valve and the whole tube out (fig. 52).

Caution: Always push the valve through the hole before removing the tube. Removing the tube by pulling the valve is apt to cause a leak around the valve.

(*b*) The bead has already been loosened in step No. 4. Force part of it into the well. Stand the tire and wheel upright and pry the wheel out of the tire (fig. 53).

FIGURE 48.—Unlocking continuous ring removable flange.

FIGURE 49.—Removing continuous ring removable flange.

FIGURE 50.—Soaping bead and rim.

FIGURE 51.—Forcing bead into well.

FIGURE 52.—Removing flap and tube.

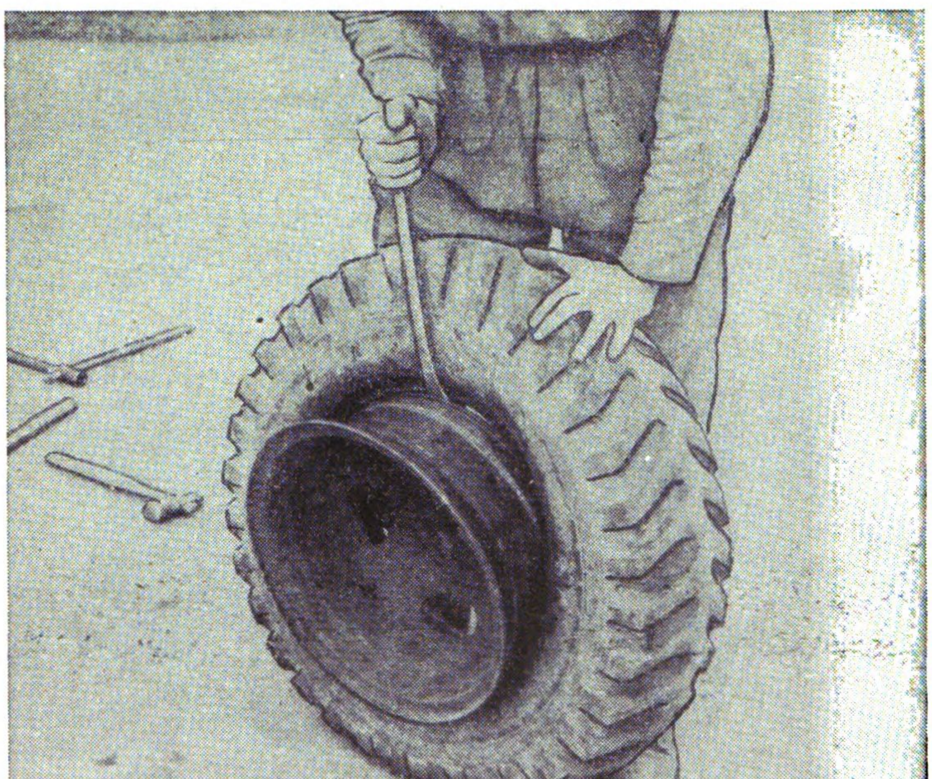


FIGURE 53.—Prying wheel out of tire.

b. To mount tire on semidrop-center rims.—Apply directional treads in proper direction (par. 9*b*). Carefully inspect the casing for breaks and remove any dust, dirt, paper, etc., found inside the tire. This foreign material can chafe a hole through the tube (fig. 36). Make sure the flap and the tube fit. Remove any dirt or rust from the rim and be sure the rim is in good condition.

(1) With the valve core in the stem, inflate the tube until it begins to fill out. Too much air will make mounting difficult.

FIGURE 54.—Inserting valve.

(2) Insert the tube, then the flap (fig. 76). When inserting the flap, make sure the edges are tucked in evenly and smoothly all around the tire.

(3) Lubricate beads and rim with a soap solution to facilitate installation. *Do not use oil.*

(4) Place the wheel (rim flange down) on three or four small blocks; 2 by 4 blocks, 3 or 4 inches long, will do.

(5) Place the tire on the rim with the valve in line with the valve hole in the rim. Pull the valve through the hole (see fig. 54).

(6) With the section of the bead near the valve (fig. 54) in the well of the rim, pry the remaining portion of the bead down over the rim with a tire iron. Work first on one side of the bead and then

on the other, so that the part of the bead opposite the valve will go on last. To force this part of the bead over the rim, it may be necessary to tap lightly on the inside of the bead with a hammer.

(7) To apply the outside bead, press a portion of the bead opposite the valve into the shallow well of the rim (fig. 55). Pry the remaining portion over the rim with the tire tool, or drive it on with a hammer. Work the bead over a little at a time by taking small "bites."

FIGURE 55.—Applying outside bead.

(8) Apply the removable flange.

(*a*) *Split ring removable flange.*—Place the end without the notch in the gutter at a point opposite the valve (fig. 45). Hold this and work around the flange, forcing it into the rim gutter.

(*b*) *Continuous ring removable flange.*—Start the ring on the rim opposite the square notch, making sure the two crescent notches rest on the sides of the wheel (fig. 56). Holding the portion opposite the square notch in the gutter of the rim, insert the tire iron in the notch and pry the remaining portion of the ring into the gutter. Assist it by rapping it with a hammer (figs. 57 and 58), working from the crescent notch nearest the square notch around to the other crescent notch.

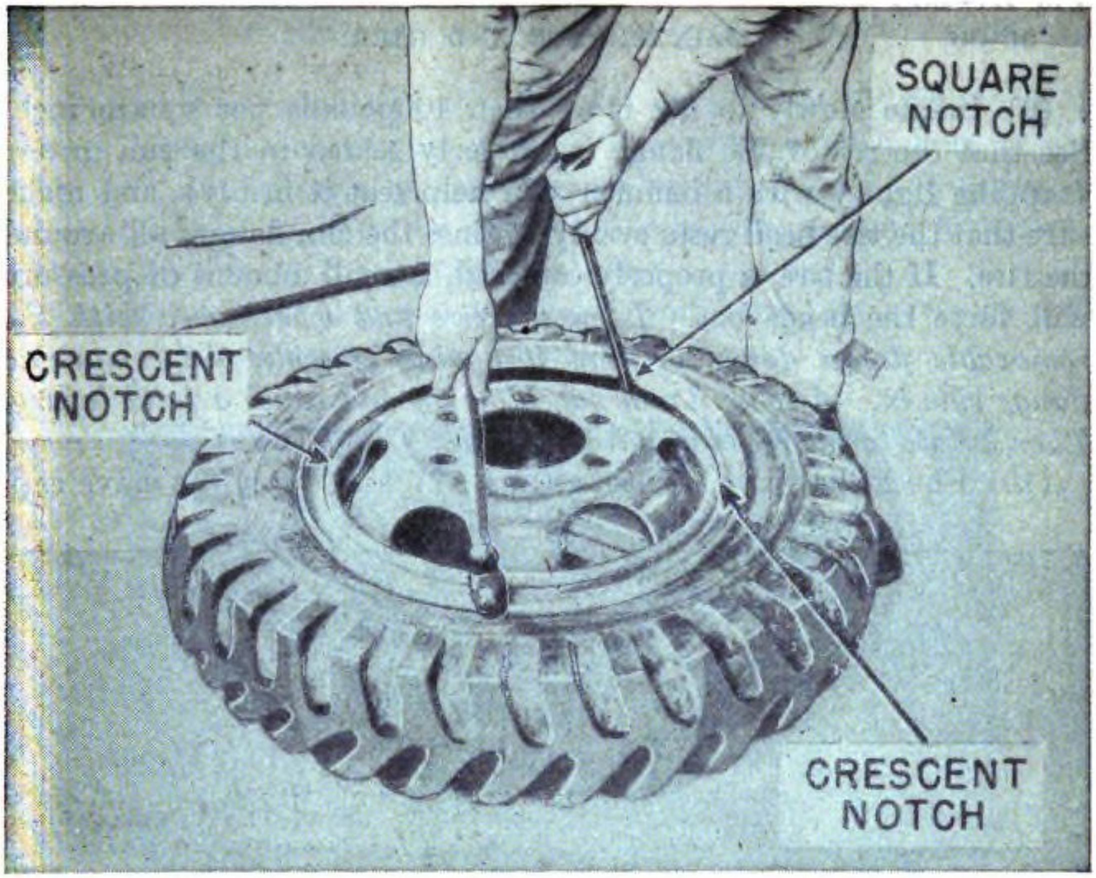


FIGURE 56.—Applying continuous ring removable flange, first step.

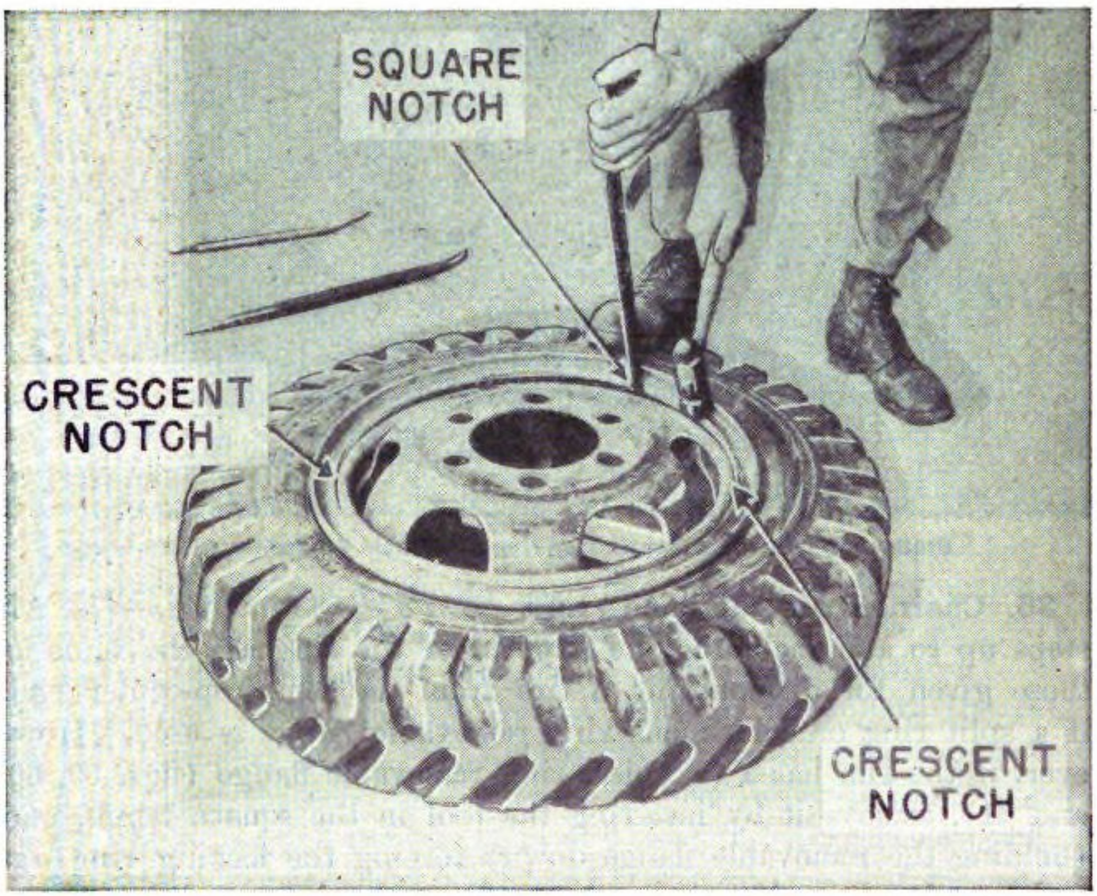


FIGURE 57.—Applying continuous ring removable flange, second step.

(9) Inflate slowly to not more than 10 pounds per square inch. See that the removable flange is properly seated in the rim gutter (tapping lightly with a hammer will help seat it firmly), and make sure that the tire bead rests evenly against the rim flanges all around the tire. If the tire is properly centered, a small amount of pressure will force the beads out. *Turn the tire and wheel over with the removable flange down, or lean it against a wall, the removable flange side in. A loose flange can blow off and cause a fatal injury. Then inflate to the recommended pressure.*

(10) Check the valve for leaks (par. 77), and apply the valve cap.

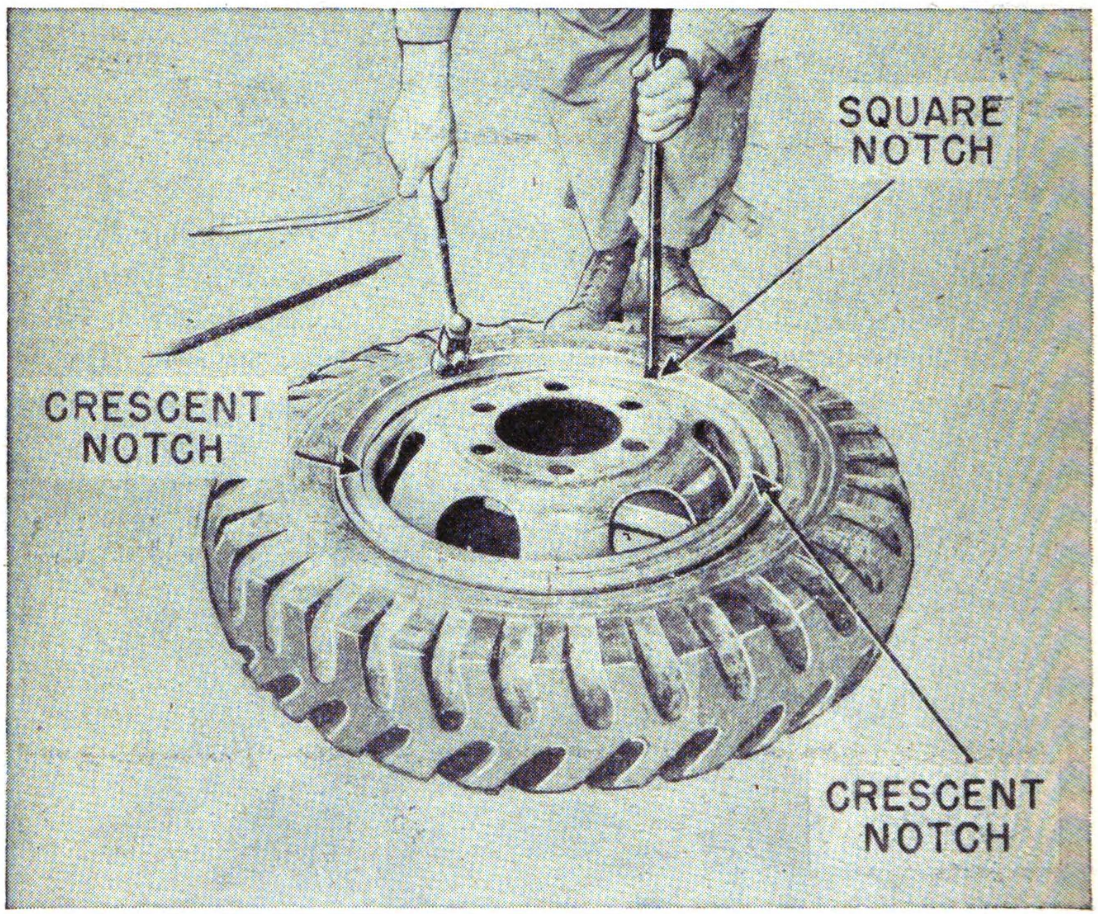


FIGURE 58.—Applying continuous ring removable flange, third step.

36. Casings on flat-base rims.—*a. To dismount tire.*—(1) All steps up to and including the removal of the ring are the same as those given for dismounting a tire from the semidrop-center rim, if a split ring or continuous ring removable flange is used. However, if the rim has a two-piece-ring removable flange (figs. 59, 60, and 61), remove it by inserting the tool in the square notch, and (holding the removable flange down) forcing the locking ring out and over the rim as in paragraph 35*a*(7).

(2) As there is no tapered bead seat on a flat-base rim, it can be pulled straight out of the casing. The valve is in a hole or slot (fig. 19), and enough of the rim can be slid out of the casing to allow the part opposite the valve slot to be lifted clear. If there is no slot, push the valve through the hole.

(3) Remove the flap and tube with your hand, but never by pulling the valve or prying with a sharp tool.

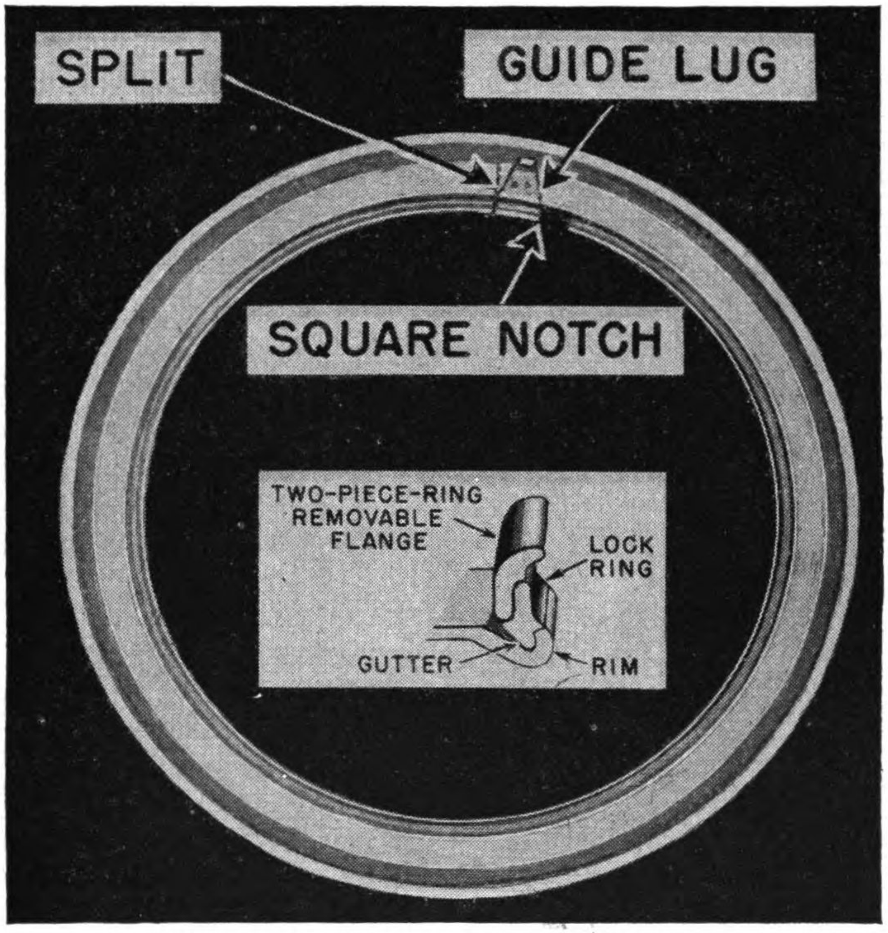


FIGURE 59.—Two-piece-ring removable flange.

b. To mount tire.—(1) Apply directional treads in the proper direction (par. 9*b*). Remove any dust or dirt found inside the tire. Foreign matter can chafe the tube (fig. 36). Carefully inspect for breaks. Make sure the flap and the tube fit. Remove any dirt or rust from the rim and be sure the rim is in good condition.

(2) With the valve core in the stem, partly inflate the tube—barely rounding it out. Too much air will make mounting difficult.

(3) Insert the tube, then the flap. When inserting the flap, make sure the edges are tucked in evenly and smoothly all around the tire.

(4) Lubricate beads and rim with a soapy solution to facilitate installation. *Do not use oil.*

(5) Place the wheel (rim flange down) on three or four small blocks on the ground; 2 by 4 blocks, 3 or 4 inches long, will do.

(6) When using a rim with a valve slot, lay the casing on the rim and pull the valve through the slot. Then lift up casing at the valve and let the inside bead drop on all around the rim.

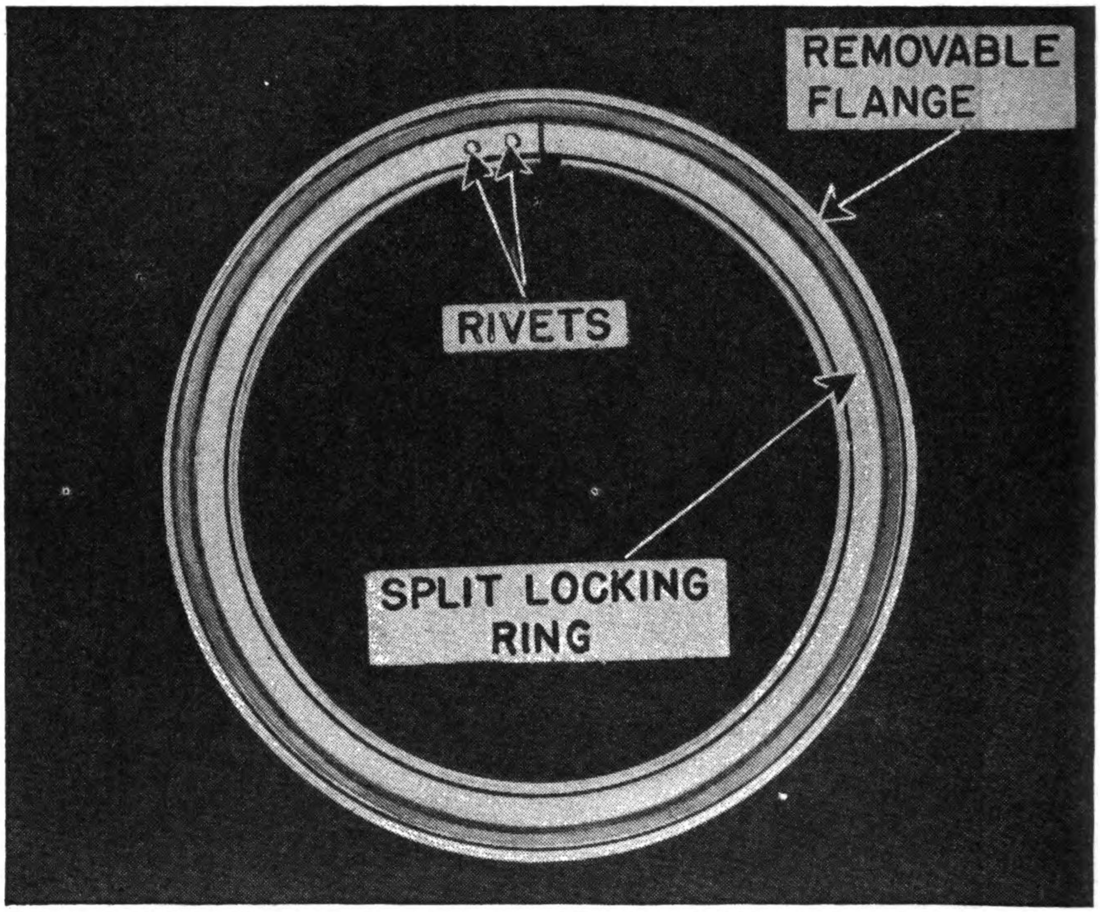


FIGURE 60.—Two-piece-ring removable flange, locking ring removed.

(7) If there is a valve hole in the rim instead of a slot, lay the tire on the ground. Hold the rim over the tire, lining up the valve with the hole. Push the valve into the tire and lower the rim into the casing. If the valve hole and the valve have been correctly alined, the valve will pop into the valve hole.

(8) Turn the tire and rim over and apply the removable flange.

(9) If a two-piece-ring removable flange (figs. 59, 60, and 61) is used, place the flange down over the gutter of the rim. To apply the split locking ring, place the end without the notch in the gutter opposite the valve. While holding this part in place (fig. 62) pry the remainder of the locking ring into the rim gutter a little at a time. Lock the notched end last.

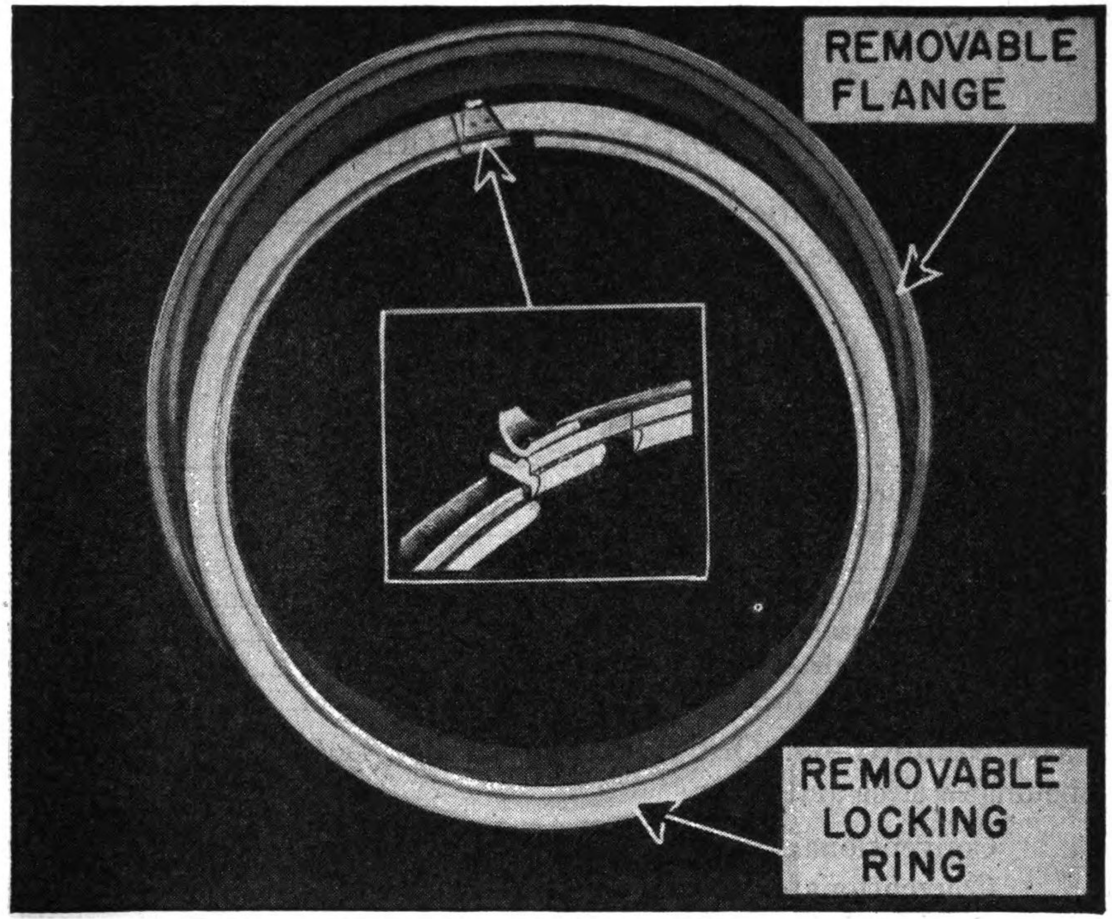


FIGURE 61.—Two-piece-ring removable flange, locking ring riveted on.

(10) If the continuous ring or split ring removable flange is used, apply as on a semidrop-center rim (par. 35*b*(8)).

(11) Inflate the same as with semidrop-center rims, observing the same safety precautions.

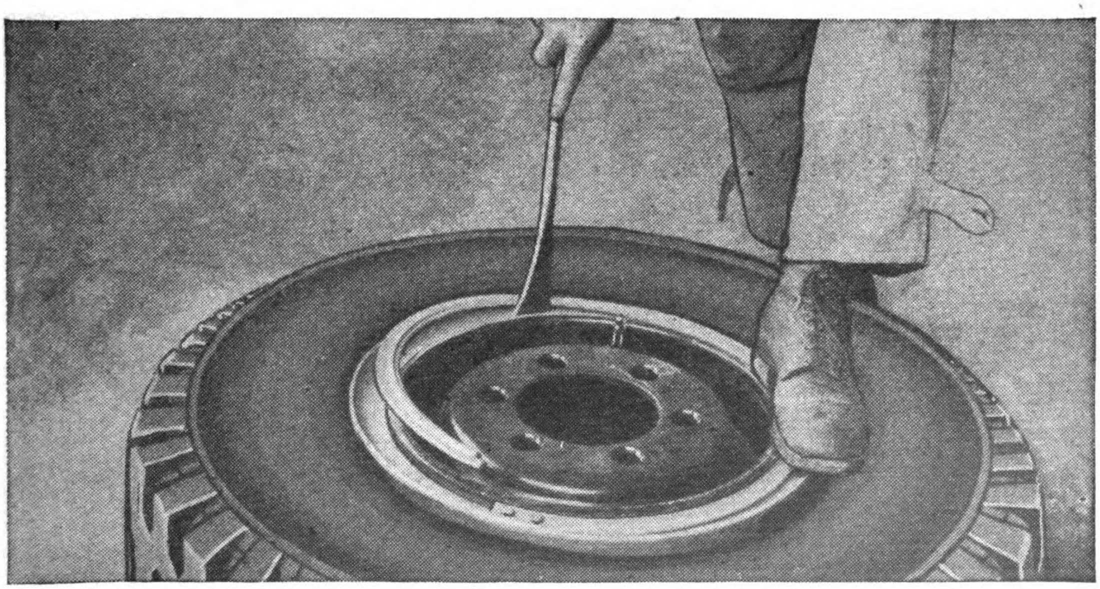


FIGURE 62.—Applying two-piece-ring removable flange.

CHAPTER 2

ORDNANCE VEHICLES

SECTION I

PNEUMATIC TIRES

37. General.—*a.* Ordnance vehicles use three combinations of pneumatic tires and tubes:

Conventional tires and conventional tubes.
Conventional tires and bullet-sealing tubes.
Combat tires and conventional tubes.

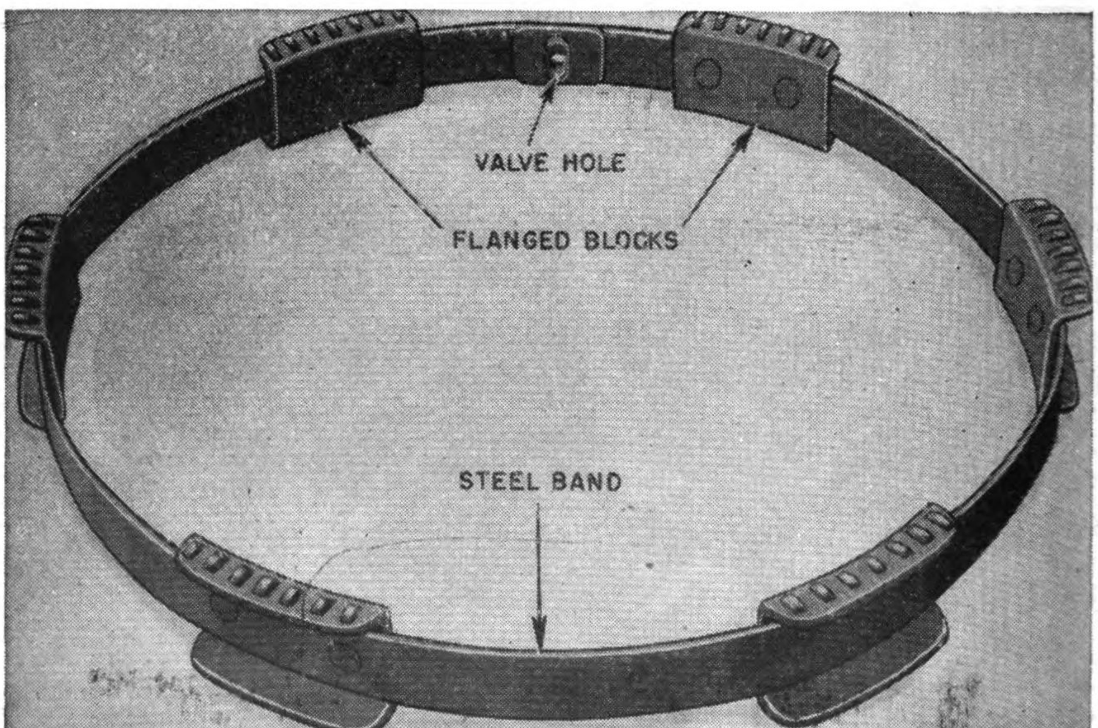


FIGURE 63.—Combat tire bead lock.

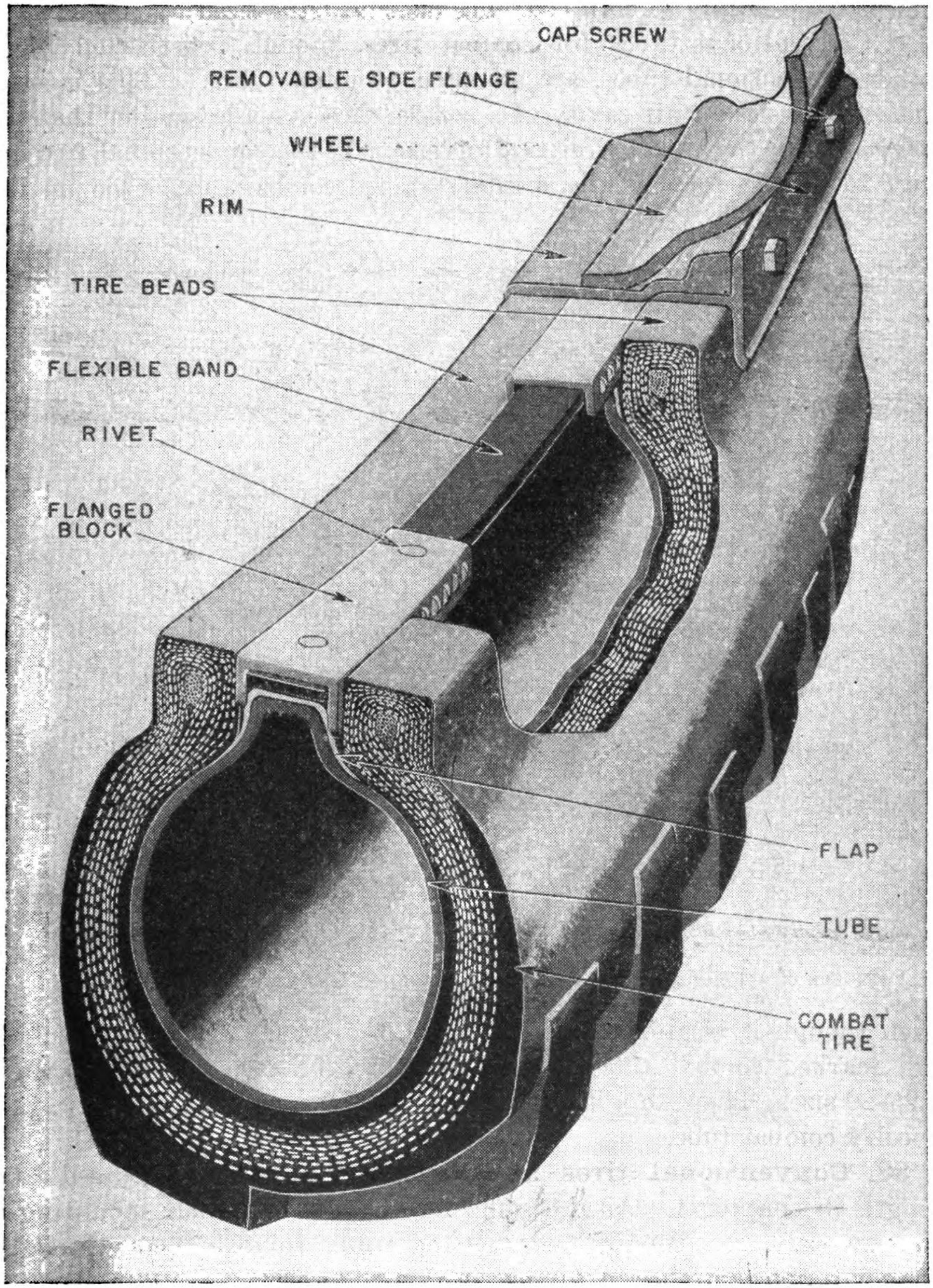


FIGURE 64.—Combat tire with bead lock.

b. Tables II and III, appendix I, show ordnance vehicles and gun carriages, tire and tube sizes, and the correct pressures to be used. These tables apply to both conventional and bullet-sealing tubes.

c. Conventional tubes for combat tires, though constructed like other conventional tubes, are stamped "combat tubes." This is because the inside or air cavity of a *combat* tire is made smaller than a *conventional* tire of a corresponding size. If the conventional tire is an 8.25-20 size, for example, a tube stamped combat tube is too small

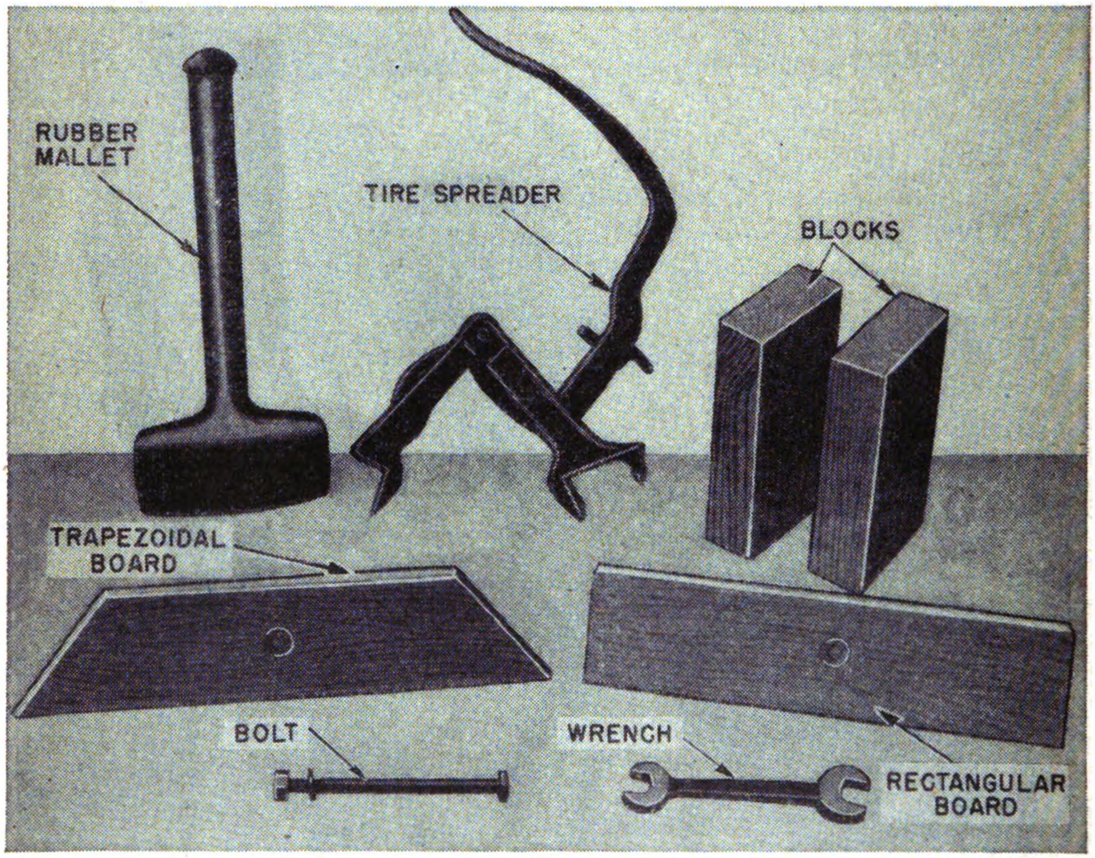


FIGURE 65.—Equipment for inserting bullet-sealing tubes in conventional tires.

even though it is also marked 8.25-20. Conversely, an 8.25-20 tube not marked combat tube is too large for the combat tire in the 8.25-20 size. Therefore, in ordering a tube for a combat tire, always specify combat tube.

38. Conventional tires and tubes.—These are discussed at length in chapter 1. As the same instructions for their mounting, dismounting, use, repair, and storage apply to ordnance vehicles, they will not be discussed further in this chapter.

39. Bullet-sealing tubes.—These tubes are of a very heavy construction, automatically seal punctures before much air can escape. Proper air pressure is as important in these tubes as in conventional tubes.

a. Inserting bullet-sealing tubes in casings requires a special procedure, because their thickness and weight makes them more difficult to handle than conventional tubes. This is outlined in paragraph 41.

b. Repair of bullet-sealing tubes should be done only by cold patching (par. 16*a*) as the heat and pressure of hot patching or vulcaniz-

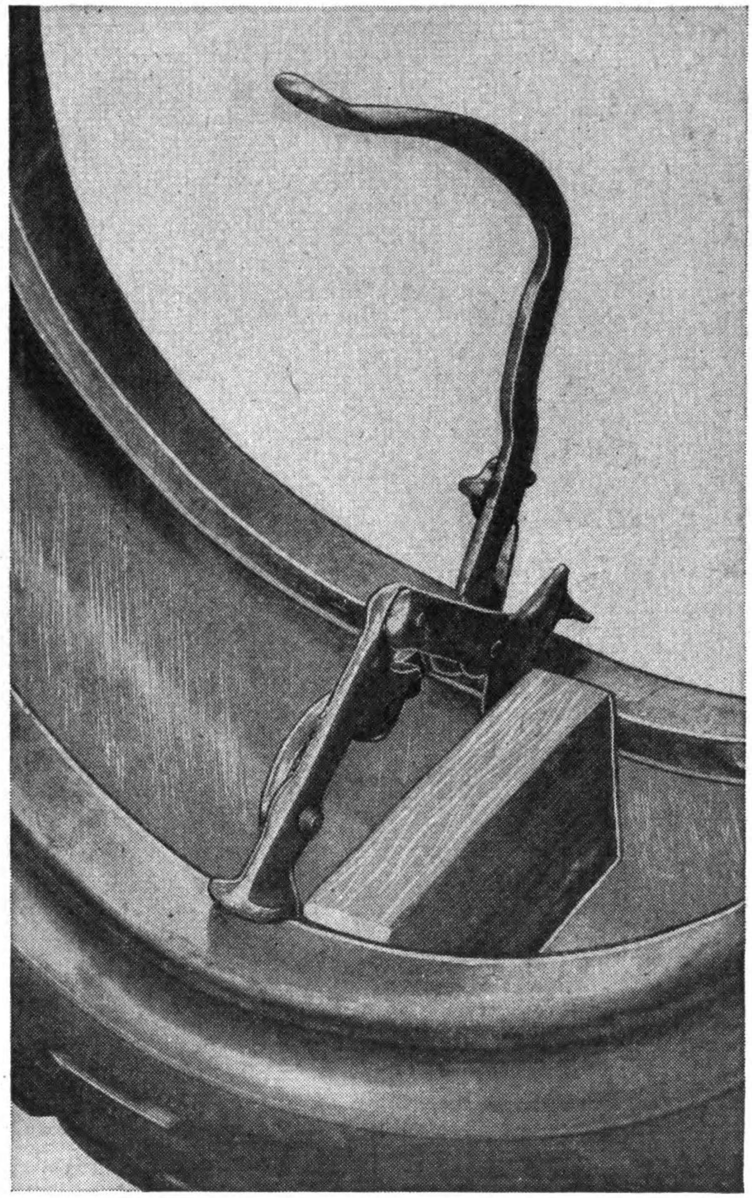


FIGURE 66.—Spreading beads.

ing causes the inner walls to stick together and destroys the bullet-sealing properties.

40 Combat tires.—These tires have a heavily reinforced casing and a bead lock, which allow them to "run flat" or completely deflated in an emergency. Under ordinary conditions, these tires must be kept inflated to recommended pressures in appendix I.

a. Bead lock.—This is a flexible steel band, to which are attached several metal flanged blocks (fig. 63). The bead lock fits between the beads, and the flanged blocks secure the beads in position, as shown in figure 64. The bead lock prevents the beads from being

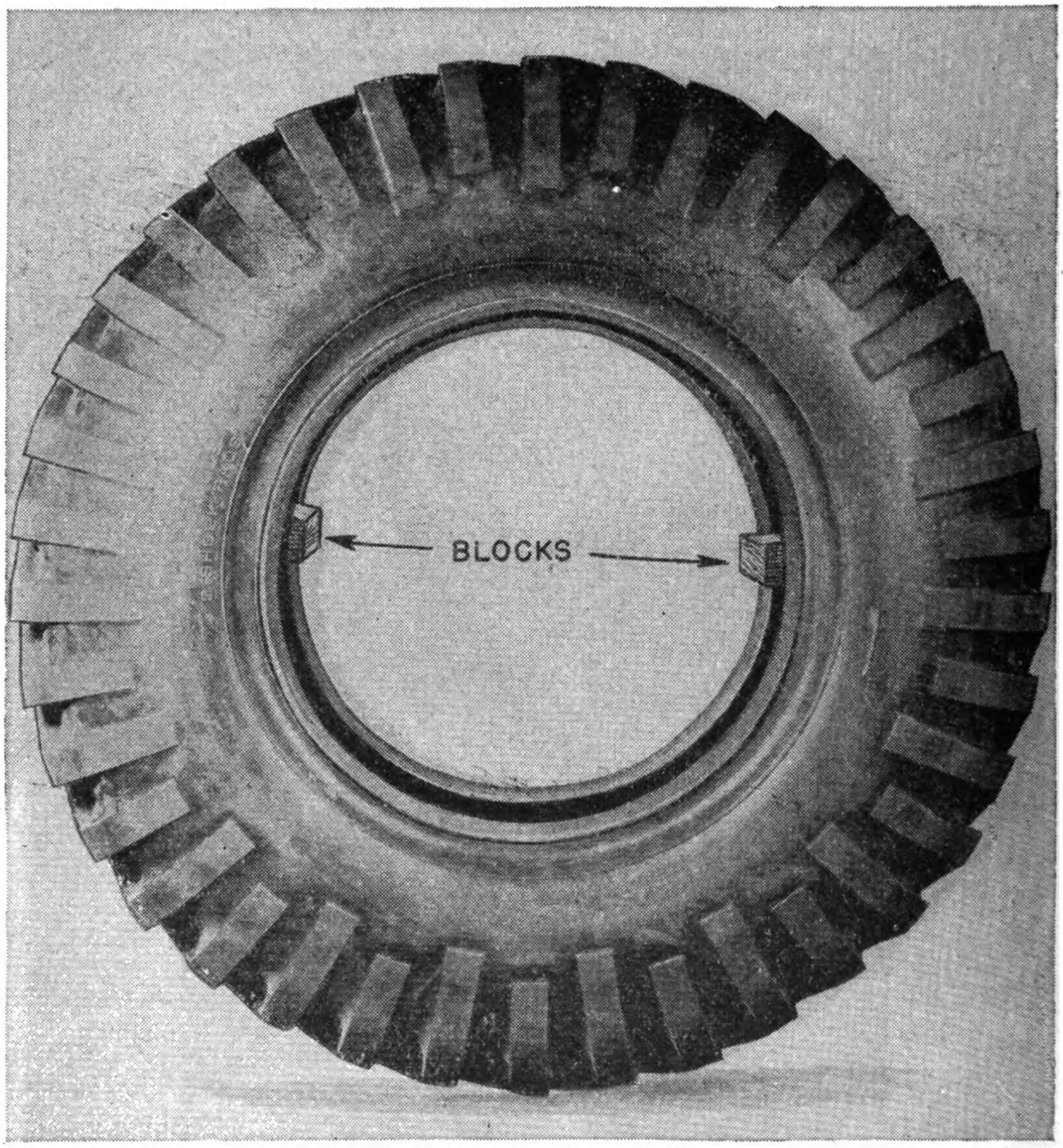


FIGURE 67.—Blocks in position.

forced together when in an emergency the tires are used without air.

b. Mounting.—The tire assembly, consisting of the tire, tube, flap, and bead lock, is mounted on a split rim wheel. For mounting and dismounting procedure see paragraphs 43 and 44.

c. Repair of casings.—This should be done in accordance with conventional methods (see par. 12).

41. Inserting bullet-sealing tubes in conventional tires.—*a. Equipment* (fig. 65).—(1) One hand tire spreader capable of spreading the beads approximately 7½ inches apart. The spreader illustrated is one of several suitable types. A power spreader, if available, will simplify the operation.

(2) Two wooden blocks, 2 by 4 by 7½ inches.

(3) One rectangular board, ¾ by 3¼ by 13½ inches with a ½-inch hole in center.

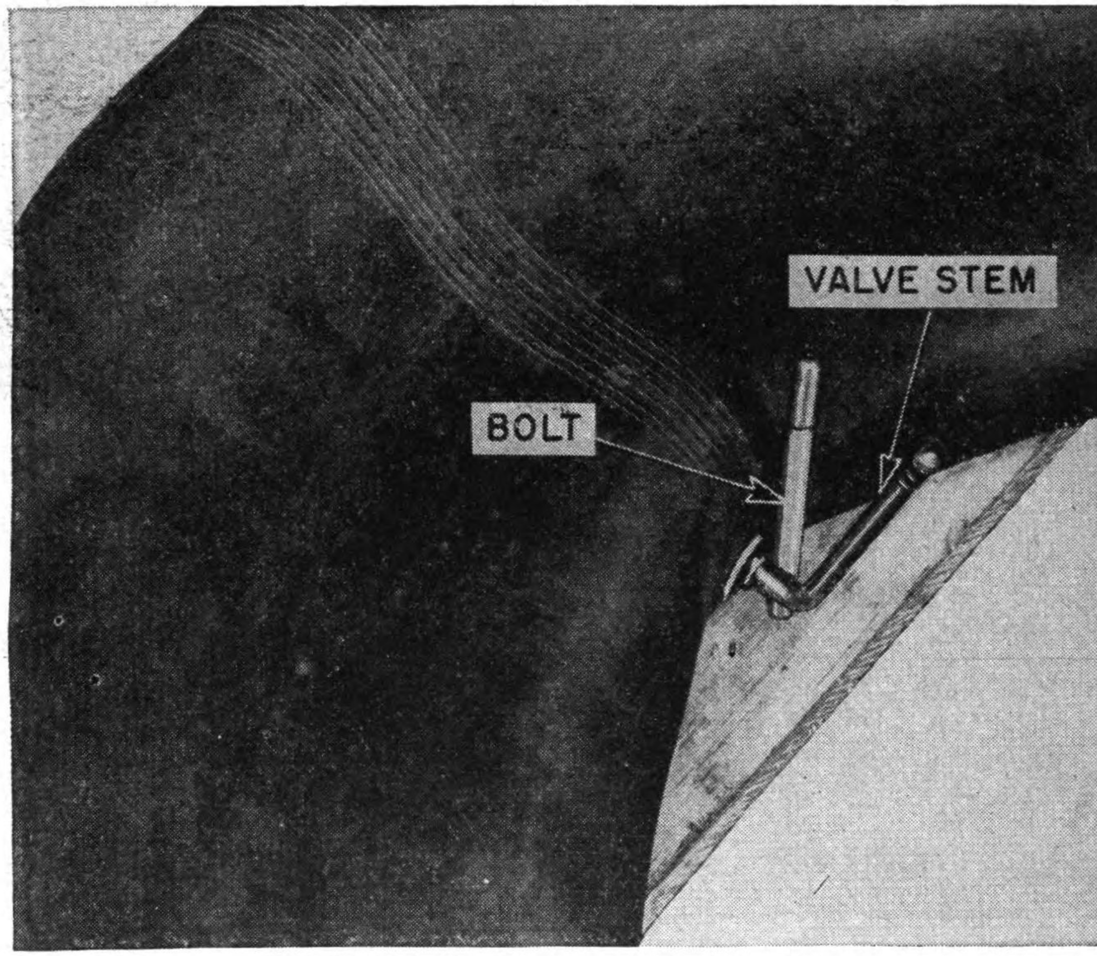


FIGURE 68.—Bolt in place, next to valve stem.

(4) One board, ¾ by 3¼ inches in cross section, trapezoidal in shape, with a long side of 14½ inches and a short side of 10 inches, and with a ½-inch hole in center, countersunk to take a bolt head.

(5) One bolt, ⅜ by 6 inches, threaded for a length of 1¼ inches or more, with nut and washer.

(6) One wrench to fit nut.

(7) One rubber mallet.

b. Procedure.—(1) Using the hand spreader, spread the beads of the casing and insert one of the 2- by 4-inch blocks crosswise between

the beads (fig. 66). Remove the hand spreader and use it again to spread the beads at a point directly opposite. Insert the other 2- by 4-inch block and remove the spreader. Stand the tires upright against a wall or other support, with the two blocks equally distant from the floor (fig. 67).

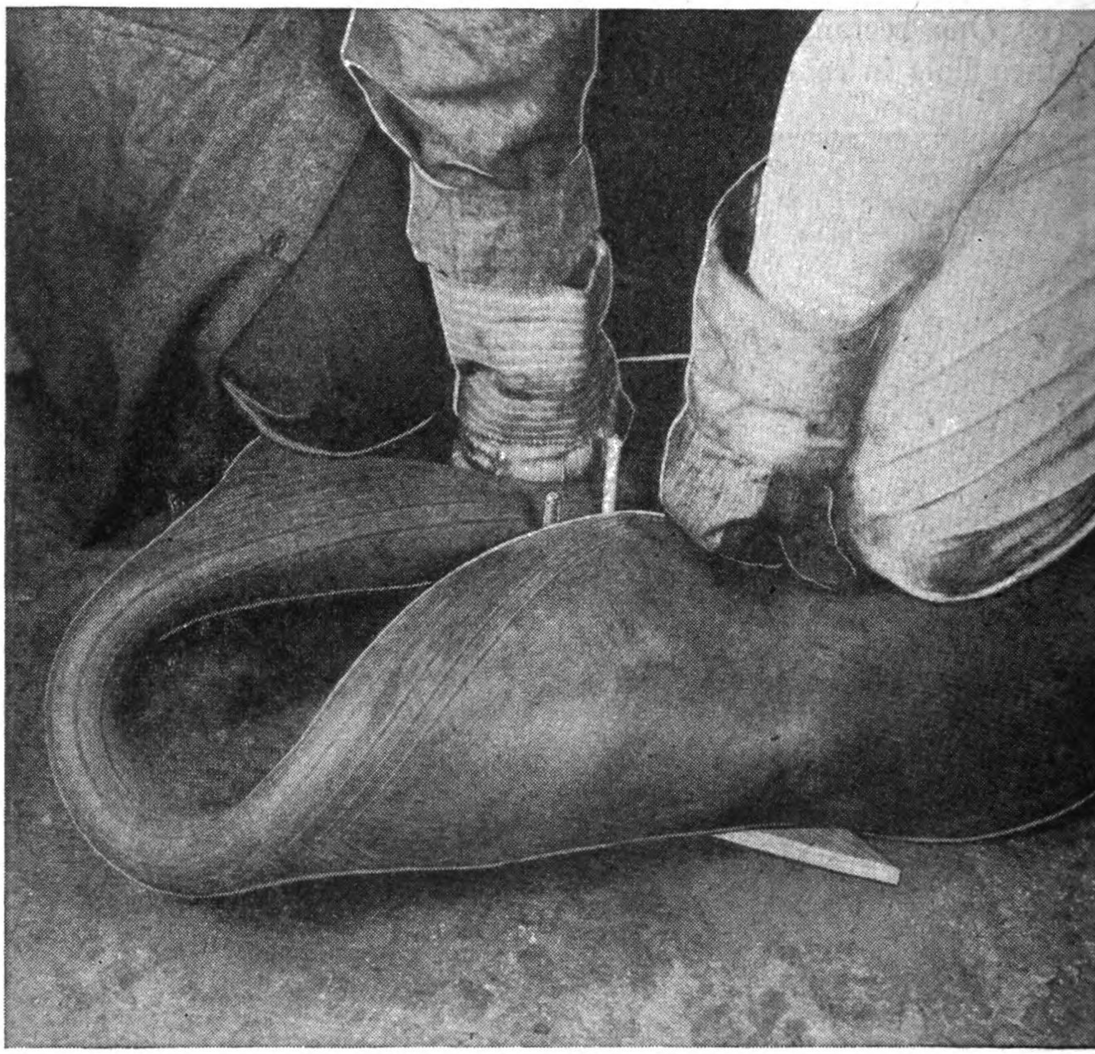


FIGURE 69.—Folding tube.

(2) Remove the valve core from the bullet-sealing tube.

(3) Deflate the tube as far as possible. The less air remaining in the tube, the easier it will be to insert the tube in the casing. A vacuum line is preferable for deflating the tube. But a satisfactory method is to place the tube on the floor, pile tires on top of it, and allow it to remain approximately an hour in this position. The tube can then be folded and deflated by further pressure. After deflating, place the valve cap on the valve to seal the tube before removing the external pressure.

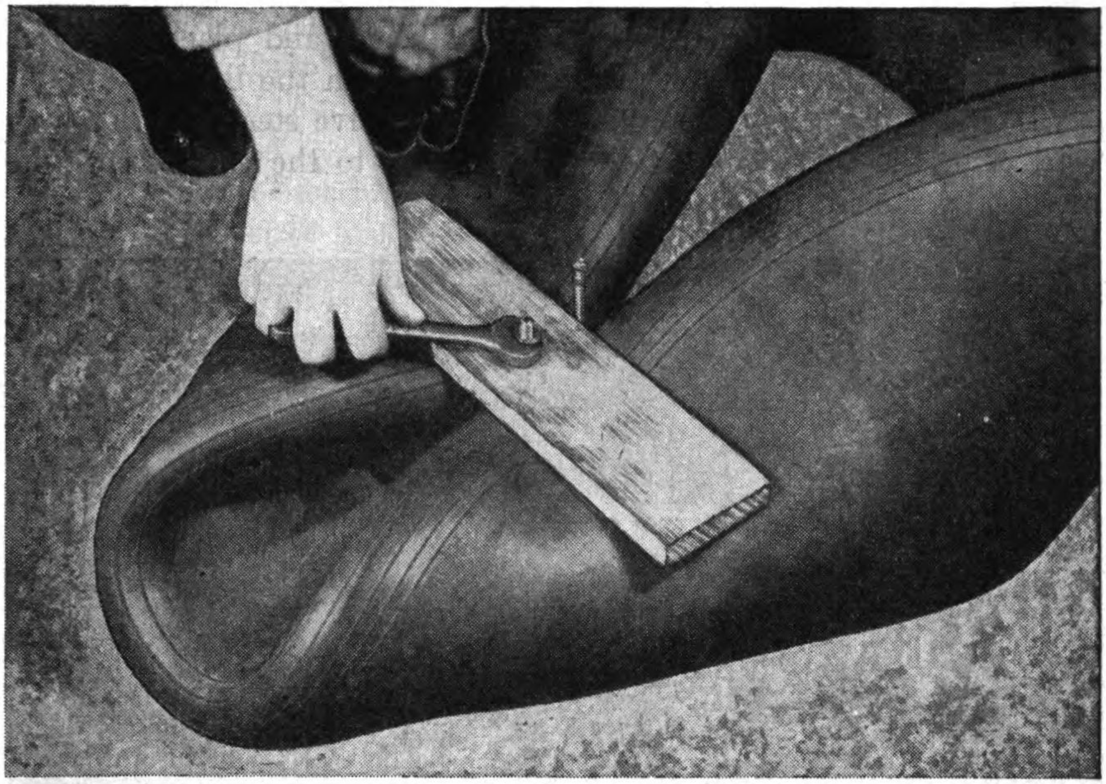


FIGURE 70.—Tightening nut.

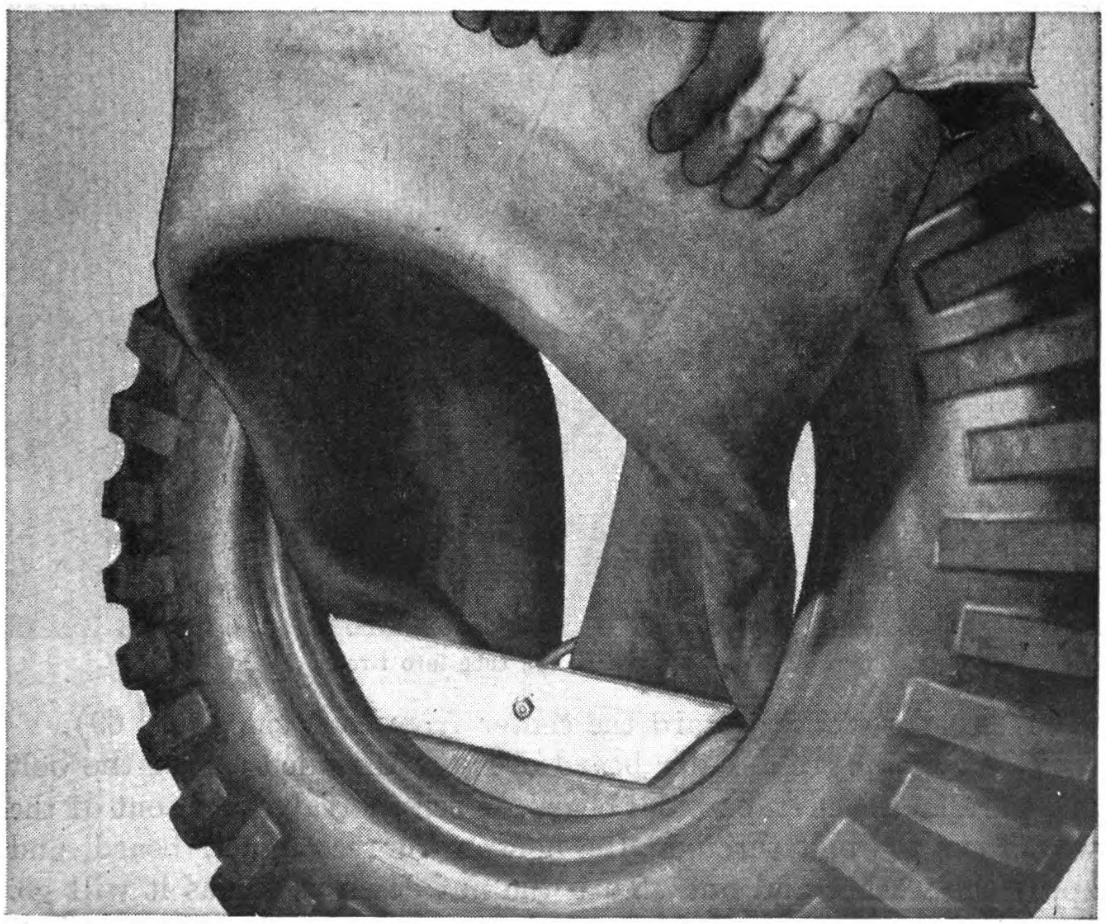


FIGURE 71.—Inserting tube.

(4) Insert the bolt in the trapezoidal board and place them on the floor with the bolt pointing upward through the board.

(5) Place the tube of the floor, with the valve stem pointing upward over the board so that the bolt is next to the valve stem and practically touching the tube (fig. 68).

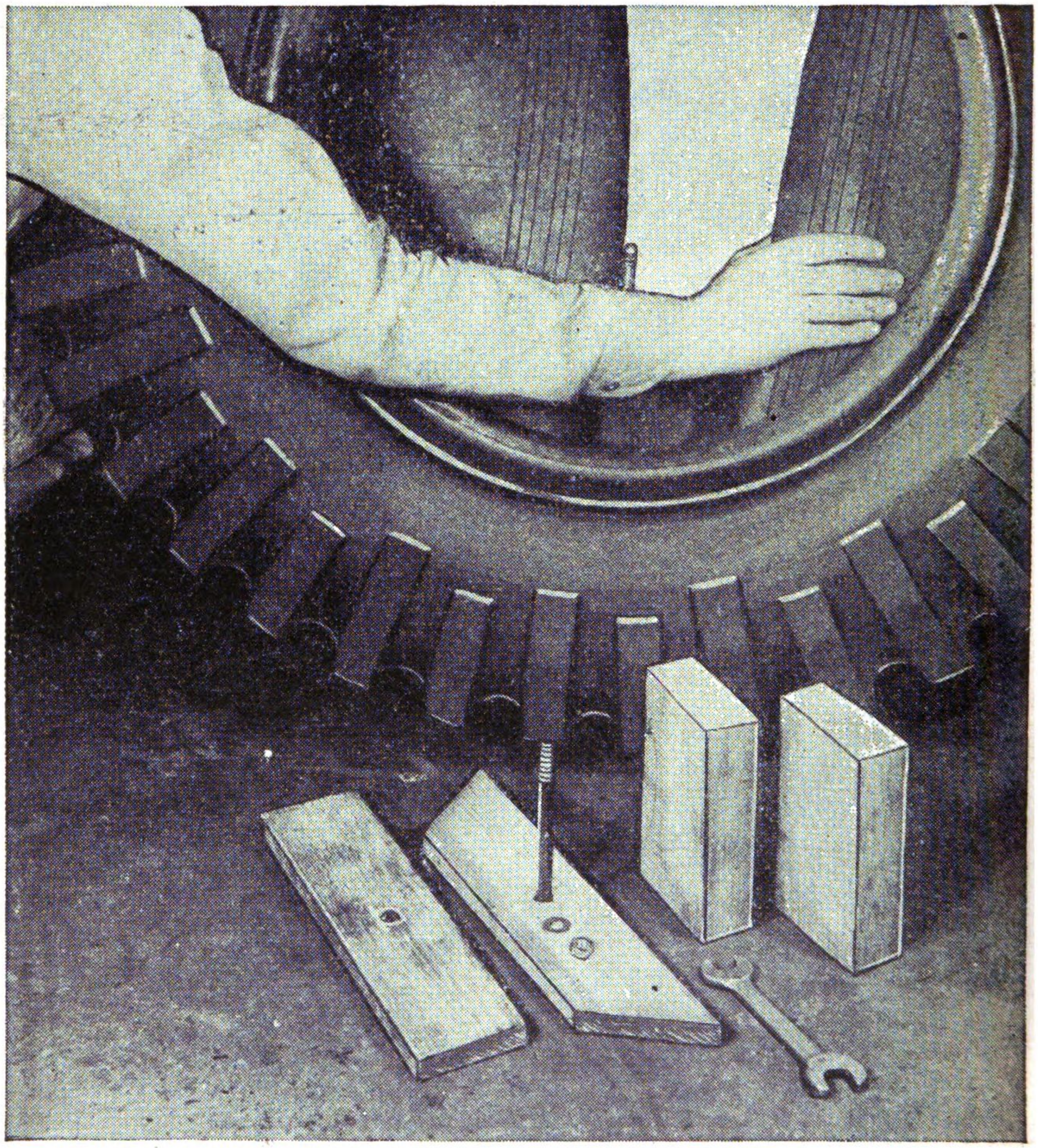


FIGURE 72.—Forcing tube into tire.

(6) Fold the tube toward the center from each side. (fig. 69).

(7) Place the rectangular board over the threaded end of the bolt and parallel to the trapezoidal board. Push the valve stem out of the way, force the bolt throught the hole in the rectangular board, and apply the washer and nut. Turn the nut down as far as it will go. Part of the tube is now held firmly between the two boards (fig. 70).

(8) Insert this part of the tube as far as possible into the casing between the two 2- by 4-inch blocks (fig. 71).

(9) Remove the nut and bolt and draw out all the wood boards and blocks.

(10) Push the tube into the tire as far as possible from this position, beginning close to the valve stem and working around, unfolding the tube into the tire (fig. 72).

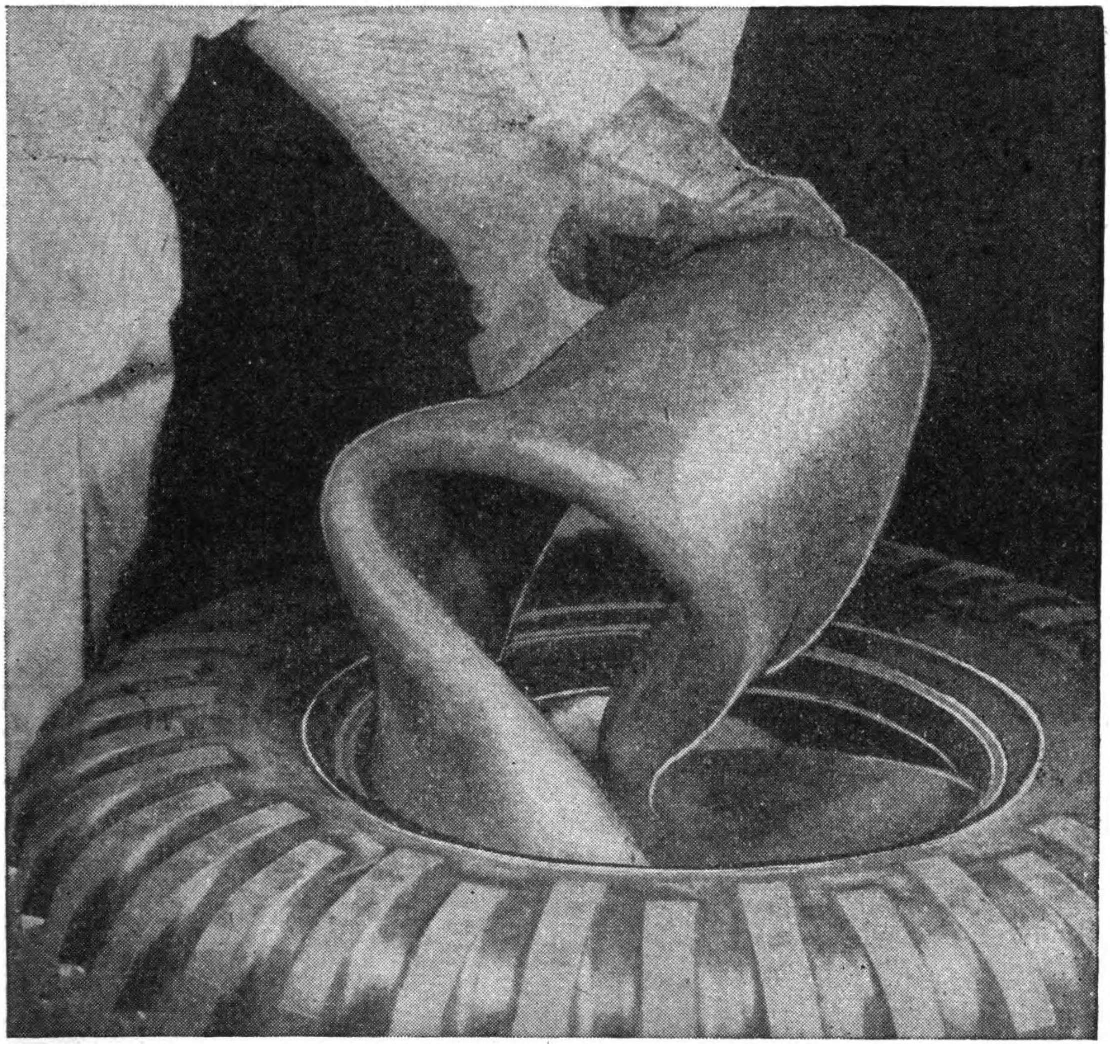


FIGURE 73.—Folding tube.

(11) Lay the tire on the floor with the valve stem pointing down and fold the remainder of the tube across, as in figures 73 and 74, so that the fold is held in place by the beads of the casing. Approximately half of the tube should be in the tire at this point.

(12) Turn the tire over.

(13) Remove the valve cap and partly inflate the tube. This will force the tube into the casing. If necessary, use a rubber mallet to jar it into position (fig. 75).

(14) Remove the valve cap and allow the tube to deflate.

(15) Stand the tire upright and push or hammer the rest of the tube into the casing with a rubber mallet.

(16) After inserting the flap (fig. 76 and par. 17) to protect the tube from the rim, proceed with inserting the valve core and mounting the tire as for any conventional tires. (See par. 77 and sec. VI, ch. 1.)

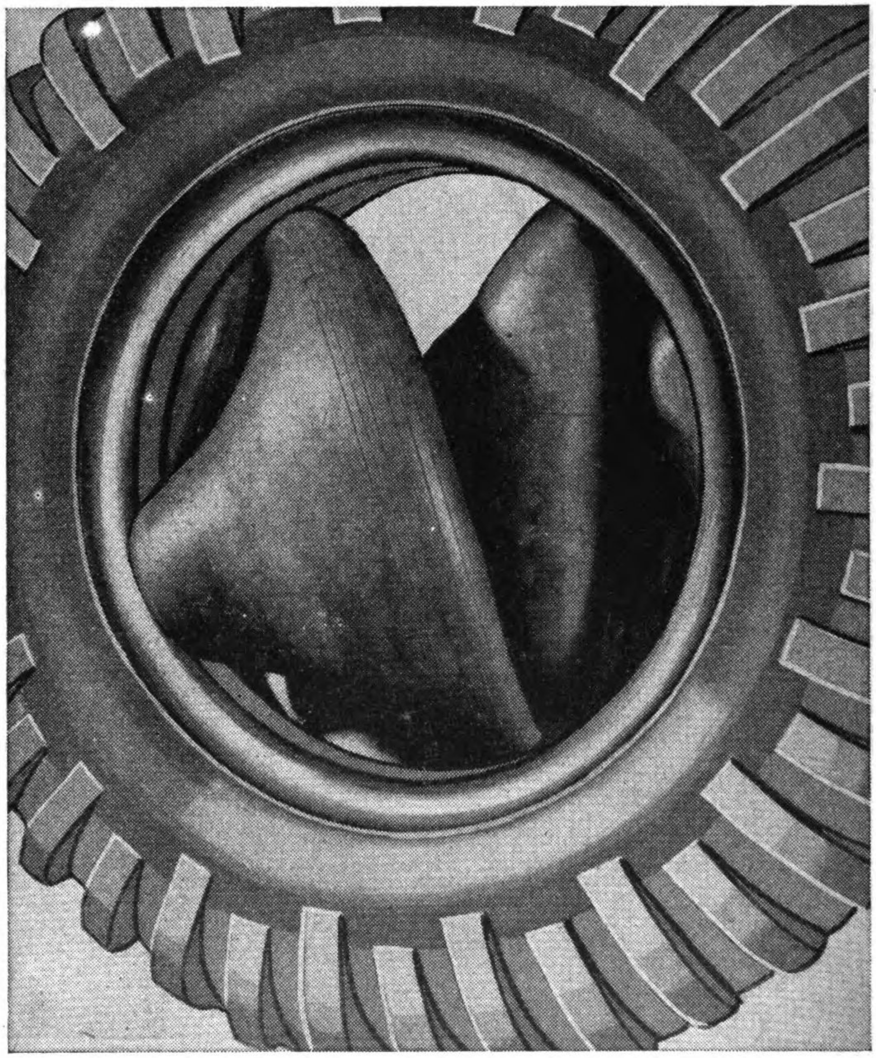


FIGURE 74.—Folded tube.

42. Removing bullet-sealing tube.—*a.* Remove the valve cap and valve core to allow the tube to become deflated as far as possible before removing the tire from the wheel. The tire assembly is removed from the wheel as explained in section VI, chapter 1.

b. Remove the flap and then the tube by reaching in between the tube and the casing and pulling the tube straight out. *Never* remove the tube by pulling on the valve stem, as this causes air leakage around the stem.

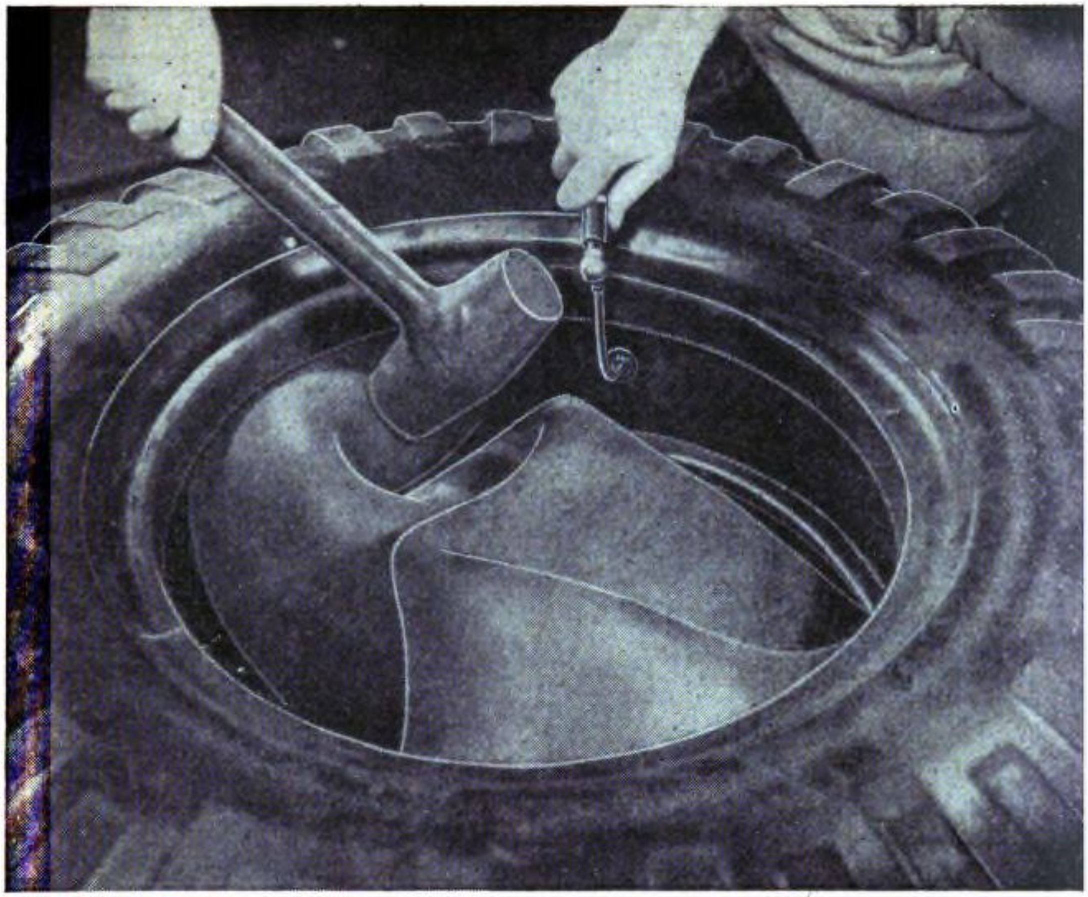


FIGURE 75.—Jarring tube into position with rubber mallet.

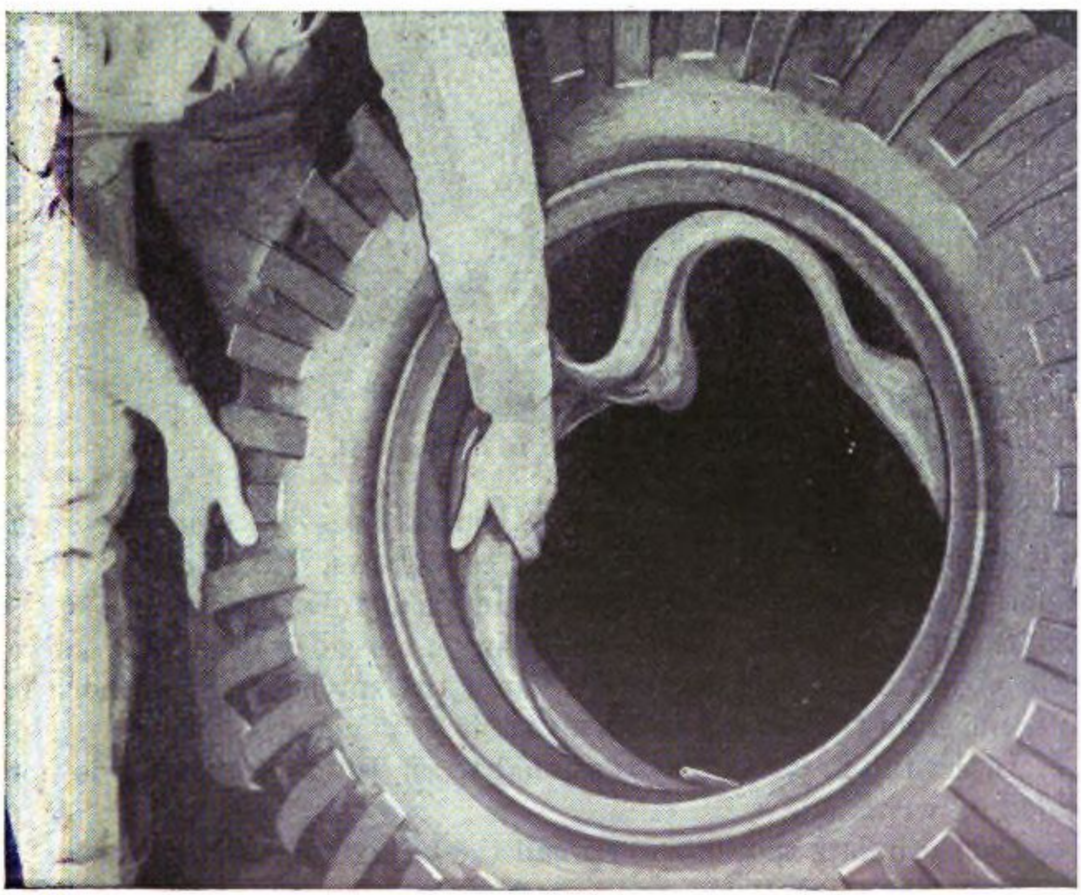


FIGURE 76.—Inserting flap.

c. Never use a sharp object to pry the tube out of the casing, as this may cut the rubber. If necessary, however, a tool which has no sharp edges, points, or corners (such as the rounded handle of a broomstick) may be used after the removal has been started by hand—but even this requires extreme care.

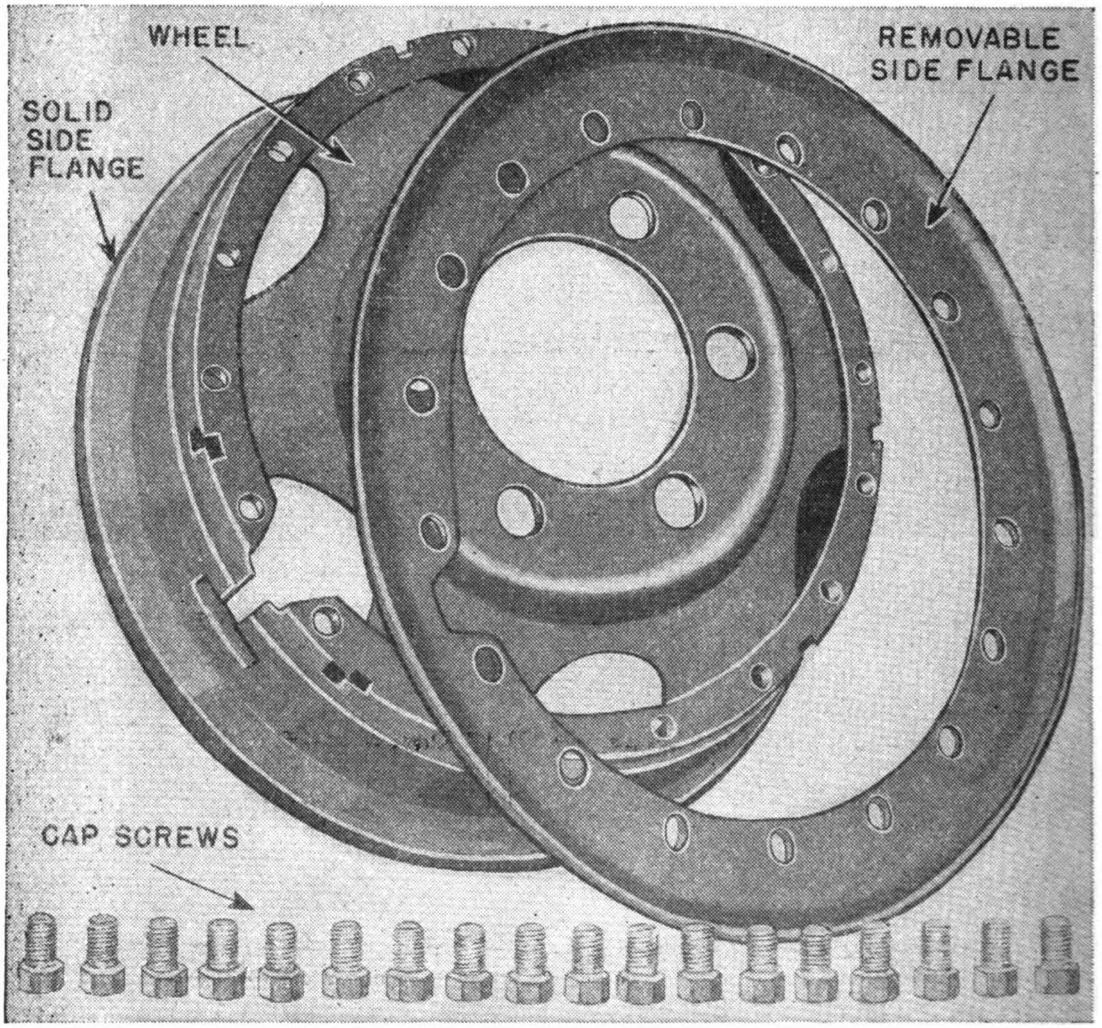


FIGURE 77.—Split rim, disassembled.

43. Mounting combat tires.—Combat tires are mounted on a split or divided rim, held together by cap screws, bolts, or nuts (figs. 77 and 78). The procedure for mounting is as follows:

a. Insert the tube in the casing, using a spreader to get the valve between the beads (fig. 79). Although the spreader shown here is different from that in figure 65, either is satisfactory.

b. Insert the flap as in conventional tires, being sure that it is not folded or wrinkled.

c. Partly inflate the tube to spread the beads (fig. 80).

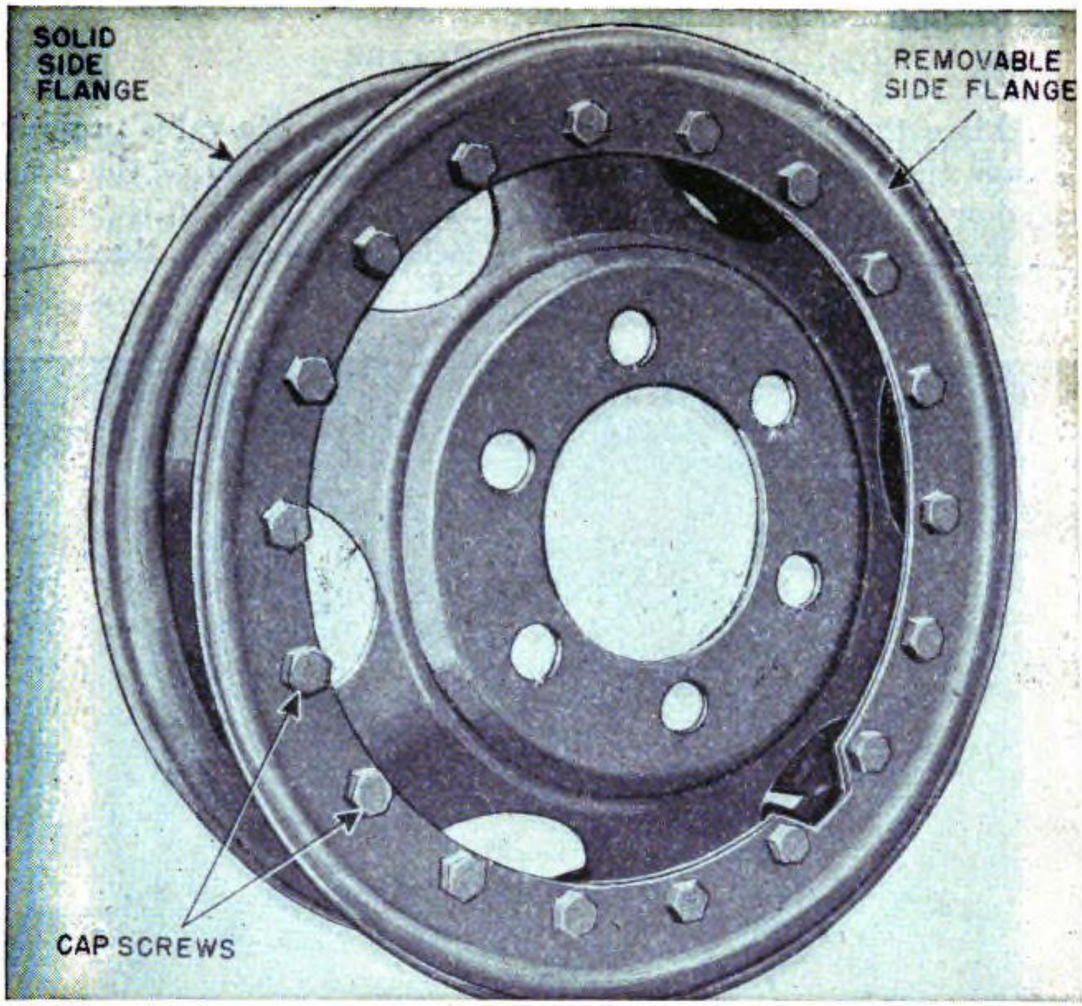


FIGURE 78.—Split rim, assembled.

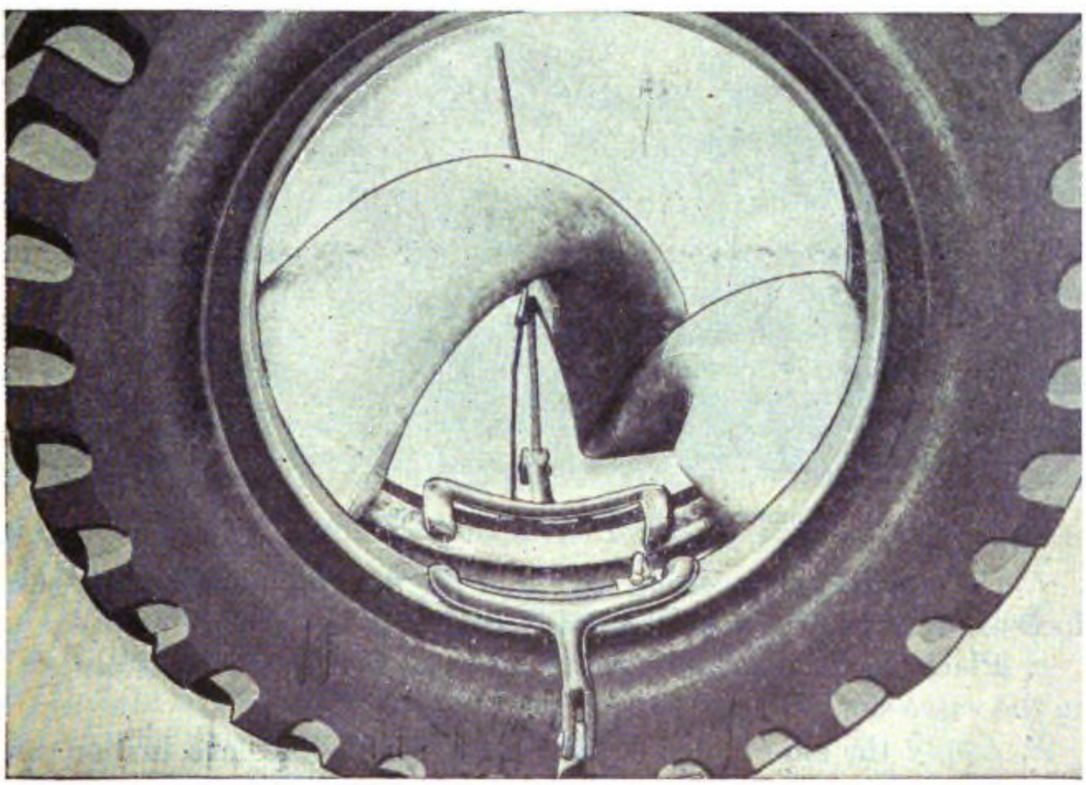


FIGURE 79.—Inserting tube.

d. Place the bead lock over the valve so that the valve projects through the hole in the bead lock. Push that portion of the bead lock down between the beads (fig. 81).

e. Fold the flexible band of the bead lock and insert it in the casing between the beads (fig. 82).

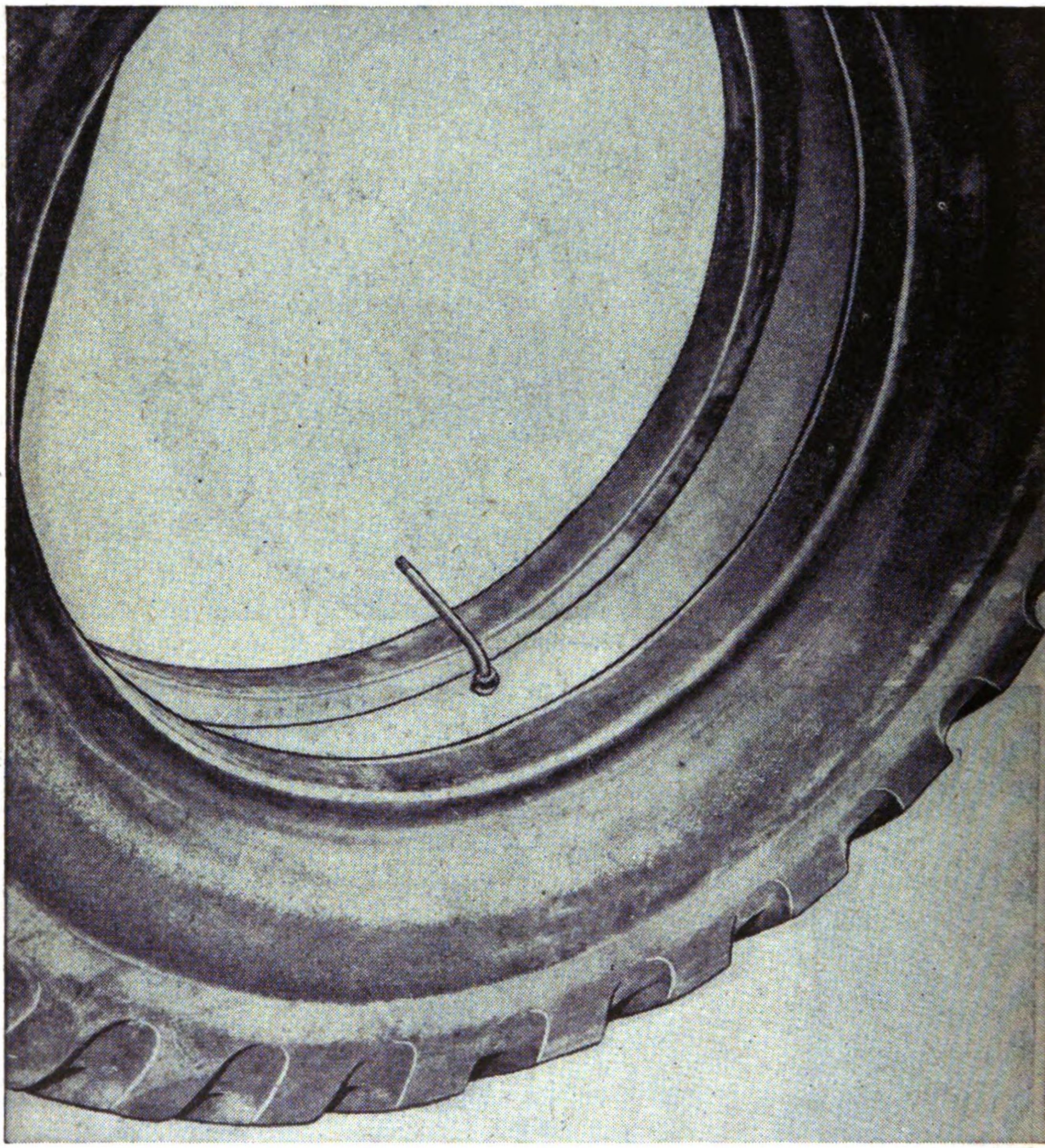


FIGURE 80.—Spreading beads by inflating tube.

f. Deflate the tube, making sure that the flanged blocks of the bead lock are centered between the beads (fig. 83).

g. Place the tire assembly on the wheel so that the valve is centered in the valve slot (fig. 84).

h. Apply the side flange so that all the bolt holes are in line and the valve notch centered over the valve (fig. 85).

i. Insert all the cap screws or bolts or nuts, screwing them down by hand only.

j. Tighten four screws equally spaced around the wheel (fig. 86) to seat the side flange evenly on the wheel: Turn a screw through one revolution with a wrench, pass on to the next one of the four and do likewise, then the next, and finally the last of the four. This

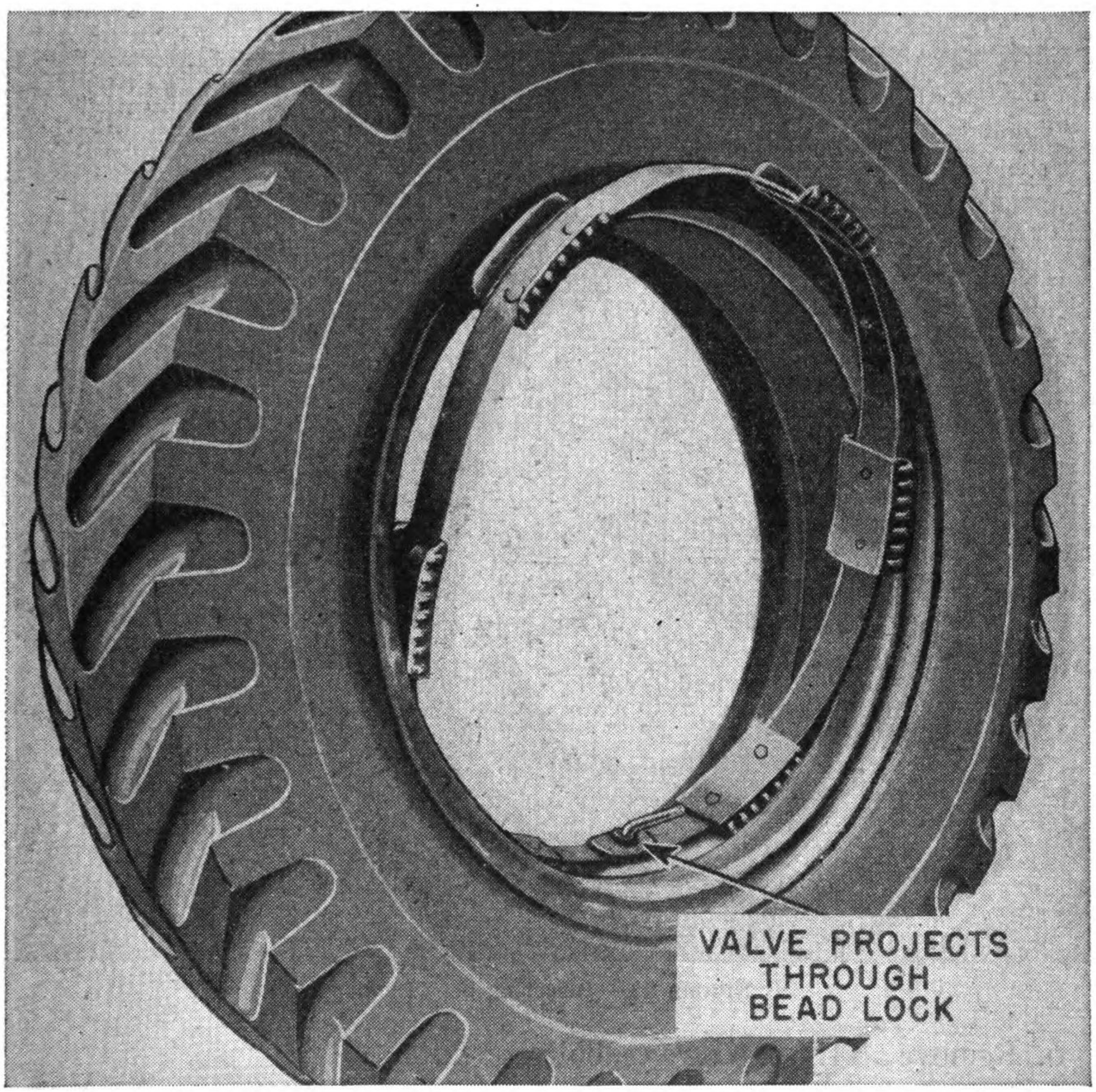


FIGURE 81.—Fitting bead lock over valve.

operation should be repeated until the four screws are tight, and the side flange is evenly seated.

k. Tighten all the other screws, starting from one point and working around the tire.

l. Inflate to the recommended pressure.

m. Apply the valve cap, screwing it down tightly by hand. Do not use pliers or a wrench.

44. Dismounting combat tires.—After removing the wheel from the vehicle—

a. Remove the valve cap and valve core, completely deflating the tube.

Caution: Be sure to deflate tubes completely before removing cap screws or bolts. Otherwise an inflated tube may easily blow the flange off, causing severe injury or death.

FIGURE 82.—Inserting bead lock.

b. Remove all the cap screws, bolts, or nuts.

c. Drive a flat tire iron between the flange and the tire, and lift the flange off.

d. Turn the tire over.

e. Loosen the wheel from the bead by prying the other flange in the same manner.

f. Lift the wheel out of the tire. The bead lock will remain in the tire.

g. Inflate the tube slowly until the beads spread away from the flanged blocks. If the flanged blocks stick to the beads, pry them loose with a tire iron.

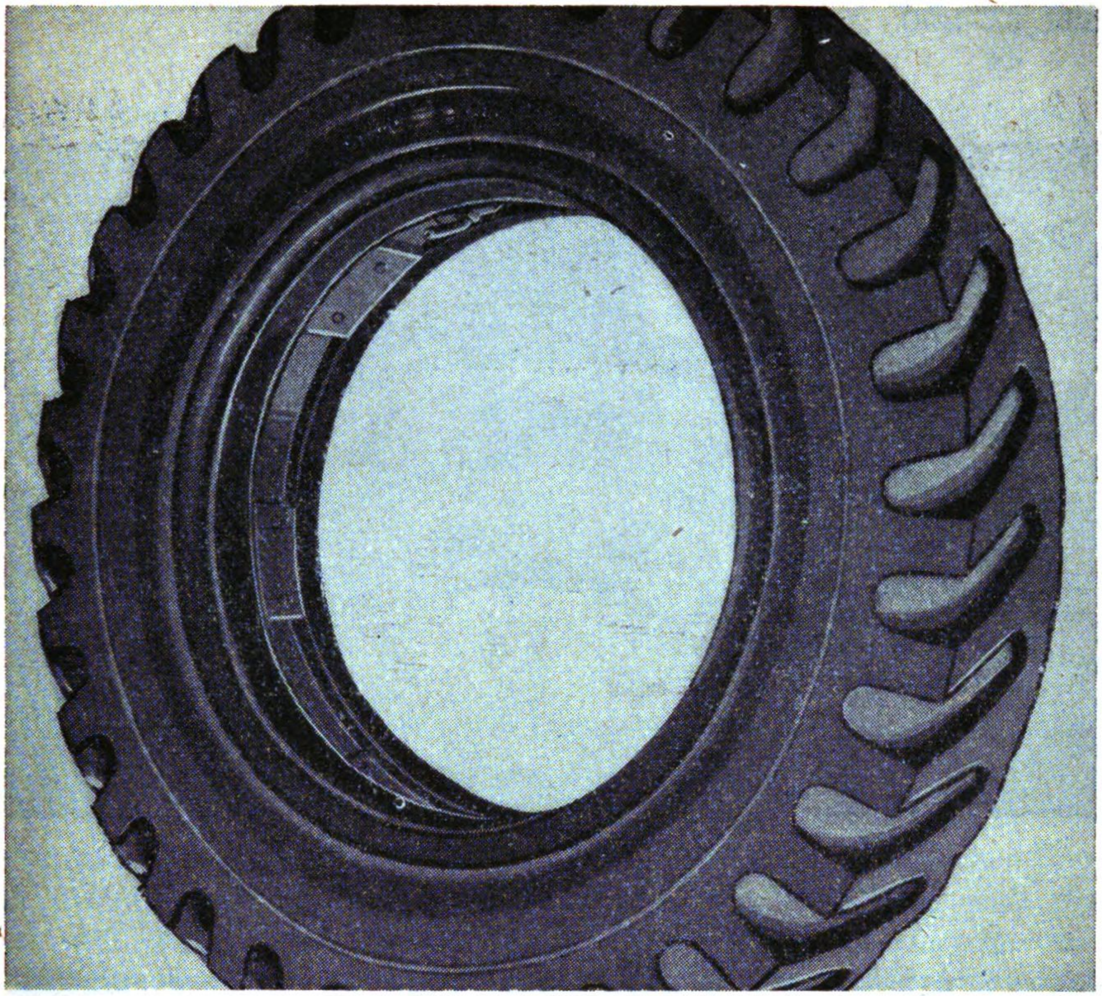


FIGURE 83.—Bead lock in place.

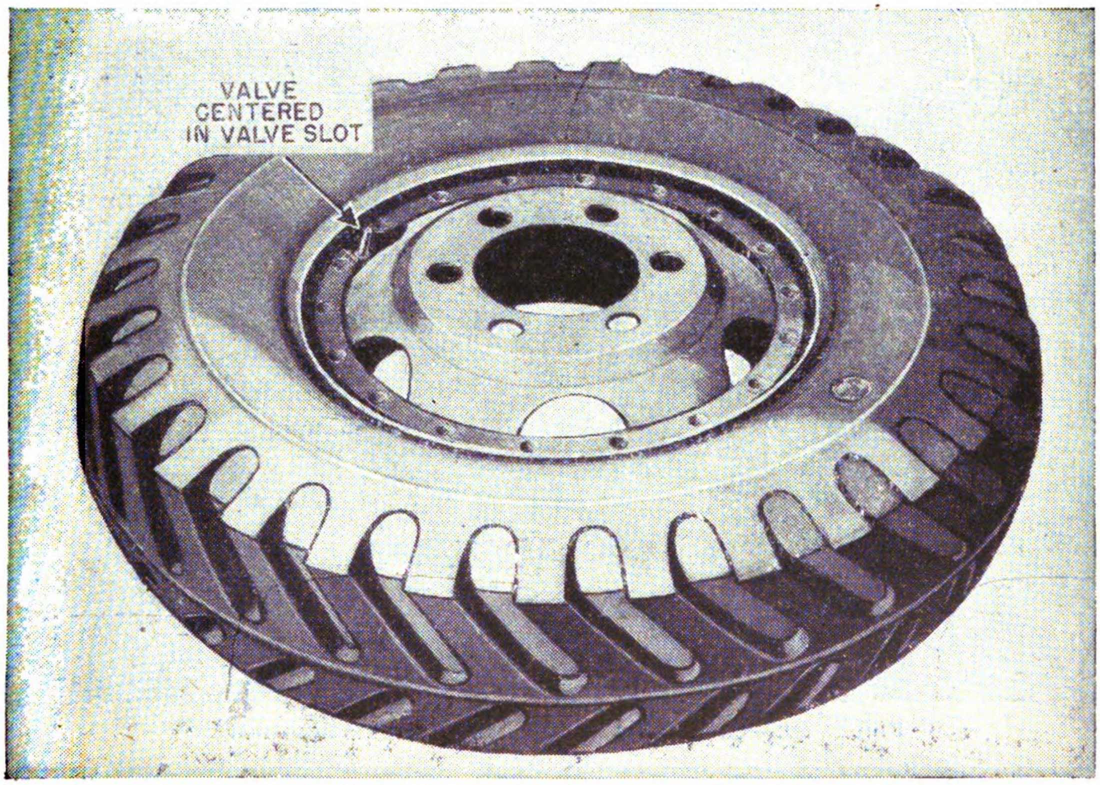


FIGURE 84.—Tire and tube assembly on wheel.

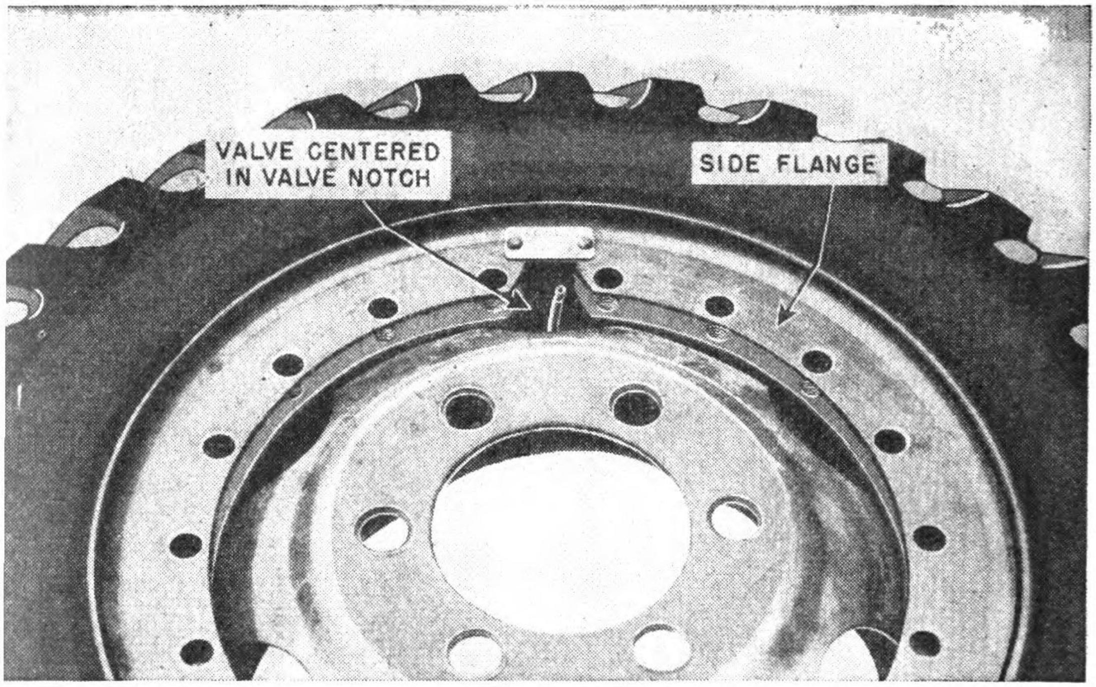


FIGURE 85.—Side flange in place.

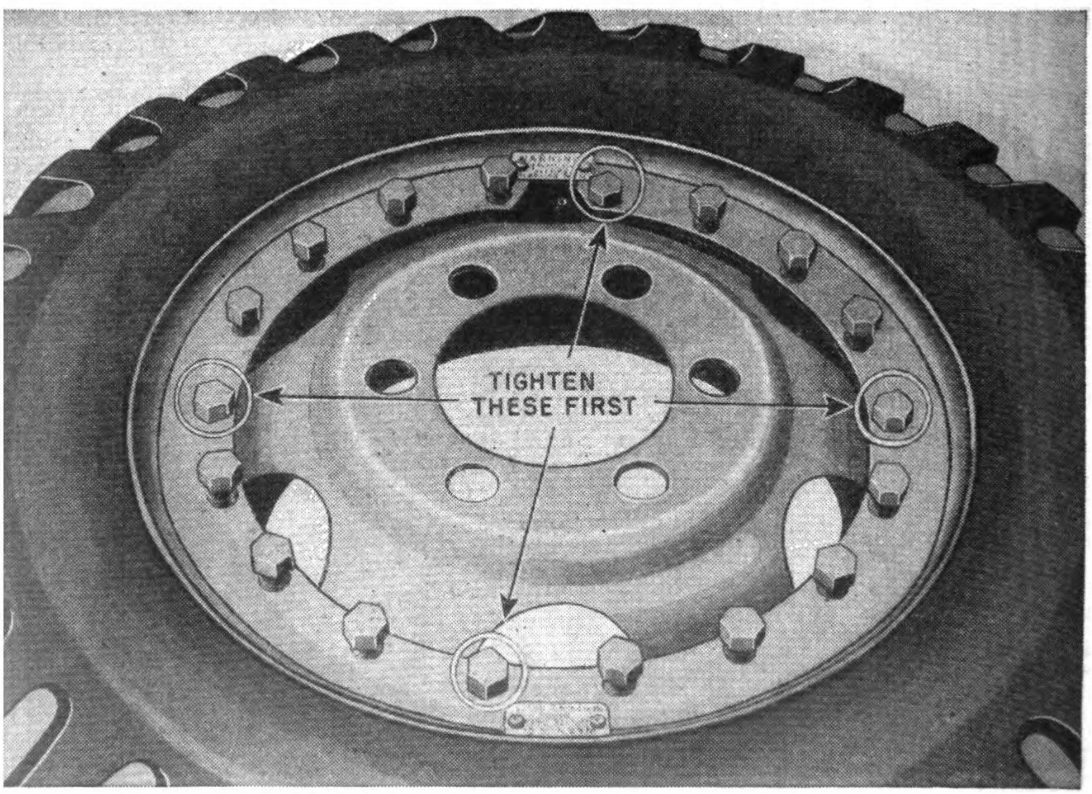


FIGURE 86.—Cap screws inserted (four screws tightened).

h. Grasp the flexible steel band of the bead lock and fold it over, as in figure 82.

i. Pull the bead lock free from the tire.

j. Completely deflate the tube again. The flap and tube can then be easily pulled out in the conventional manner.

SECTION II

TRACKS

45. Track-laying vehicles.—Tracks are used on vehicles such as the half-track car and the medium or light tank to increase mobility in cross-country work. By increasing the area of contact with the ground, tracks allow the vehicle to climb steep grades and overcome obstacles.

46. Full tracks.—The track-laying mechanism on full-track vehicles such as medium and light tanks (fig. 87), consists of—

a. Rubber track blocks that are hinged together by end connections (fig. 88).

b. Bogie wheels which carry the load of the vehicle and run on the track.

c. An idler wheel by which the tension of the track may be adjusted.

d. A driving sprocket wheel which is driven by the engine and engages projections on the end connections of the track (fig. 87).

47. Care of full tracks.—*a. Petroleum hazard.*—Grease, oil, gasoline, and other petroleum products are harmful to rubber. Therefore, the bogie tires and track blocks should be protected from them. Petroleum products that get on any rubber article should be promptly wiped off.

b. Reversing worn track blocks.—To increase the life of tracks rubber blocks may be reversed in two ways:

(1) When the track block wears unevenly, turn the entire track around end for end, reversing the direction of rotation.

(2) When the entire surface of a block is worn down almost to the metal, the track blocks may be removed individually, turned upside down and put back.

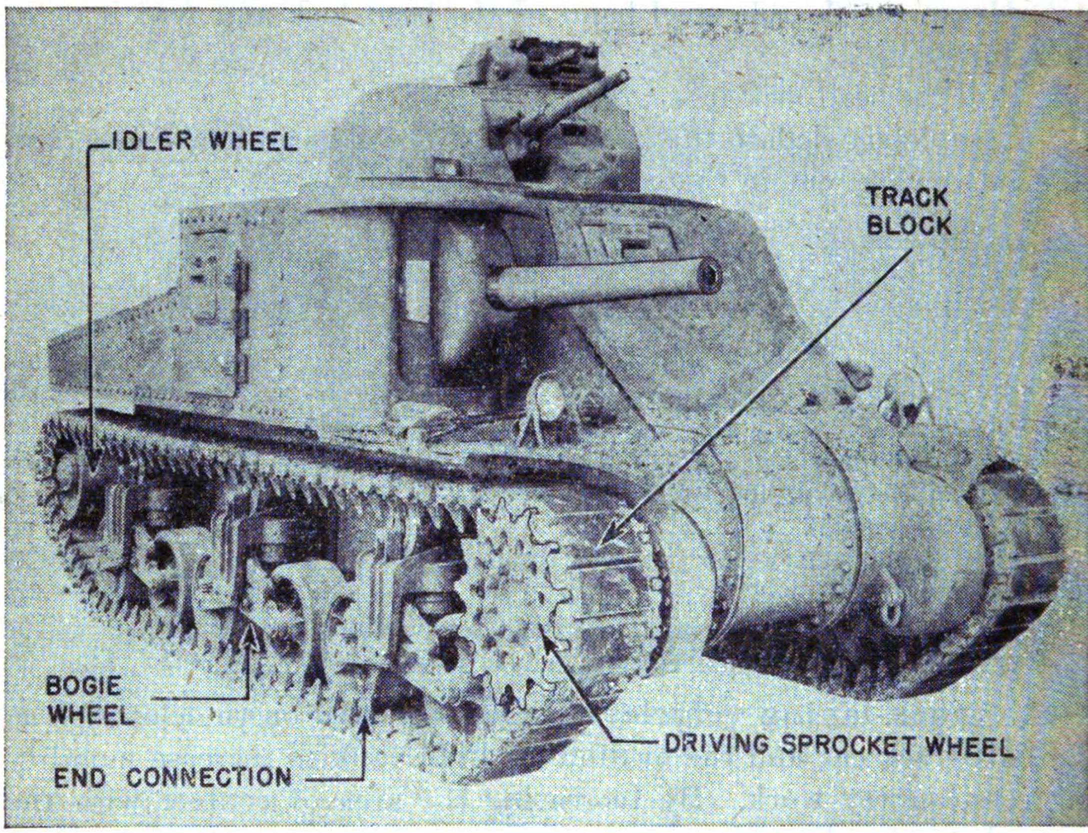


FIGURE 87.—Medium tank, showing full track.

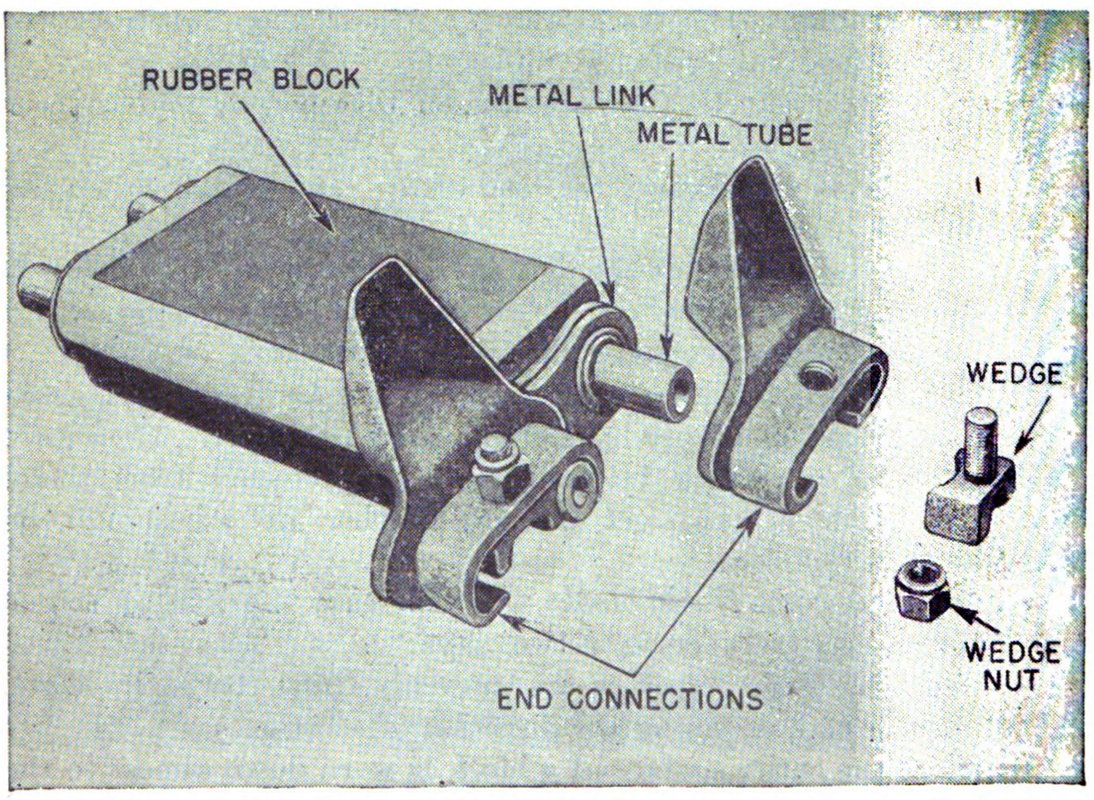


FIGURE 88.—Track block with one end connection bolted on and one disassembled.

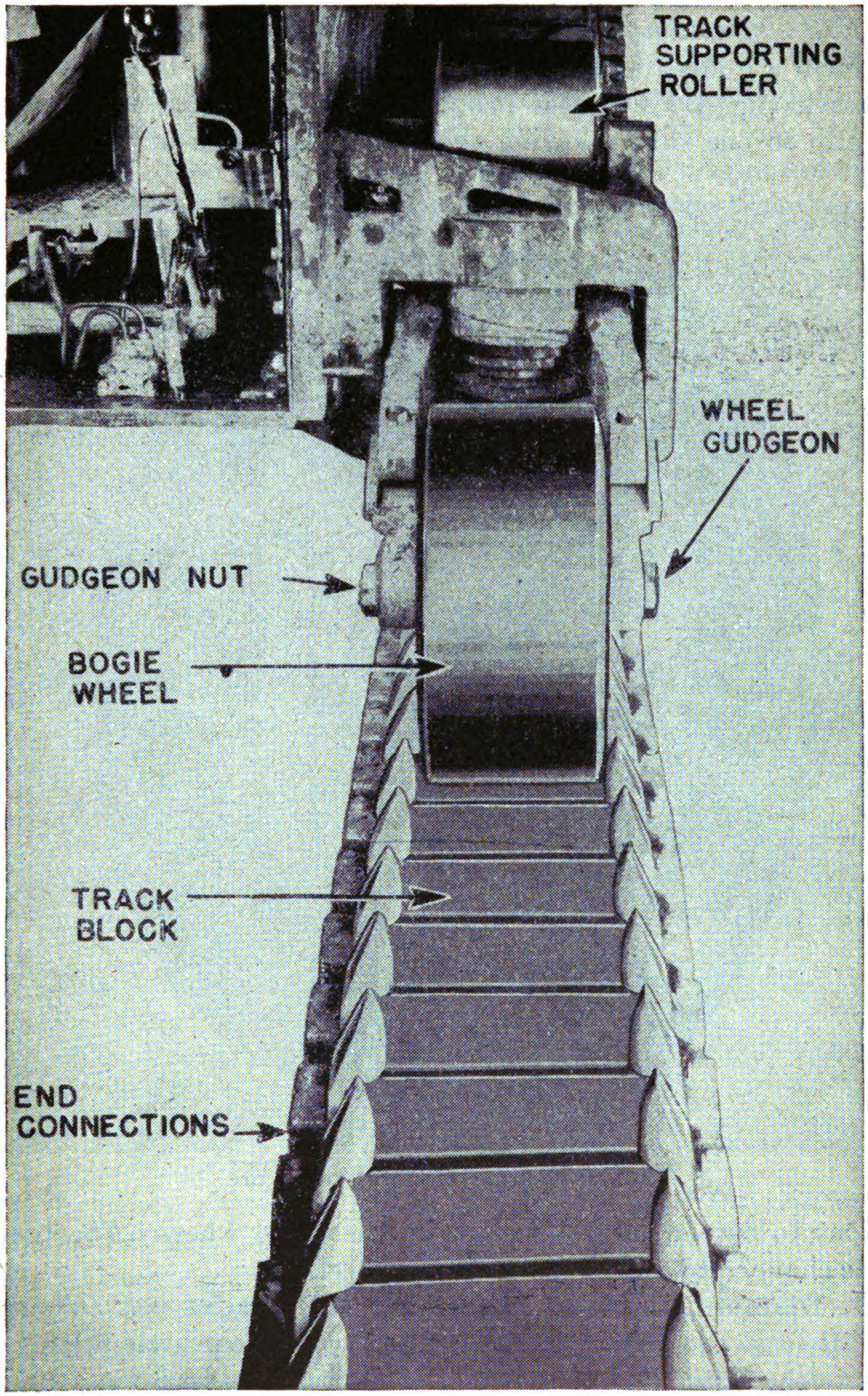


FIGURE 89.—Bogie wheel running in track.

Caution: Dented or deformed links or tubes cannot successfully be retreaded because they will not fit.

c. End connections.—These join the individual blocks of the track, and form a guide to keep the bogie wheels running in the center of the track (fig. 89). Unless proper tension is kept on the track, it will slip to one side, allowing the projecting edges of the end con-

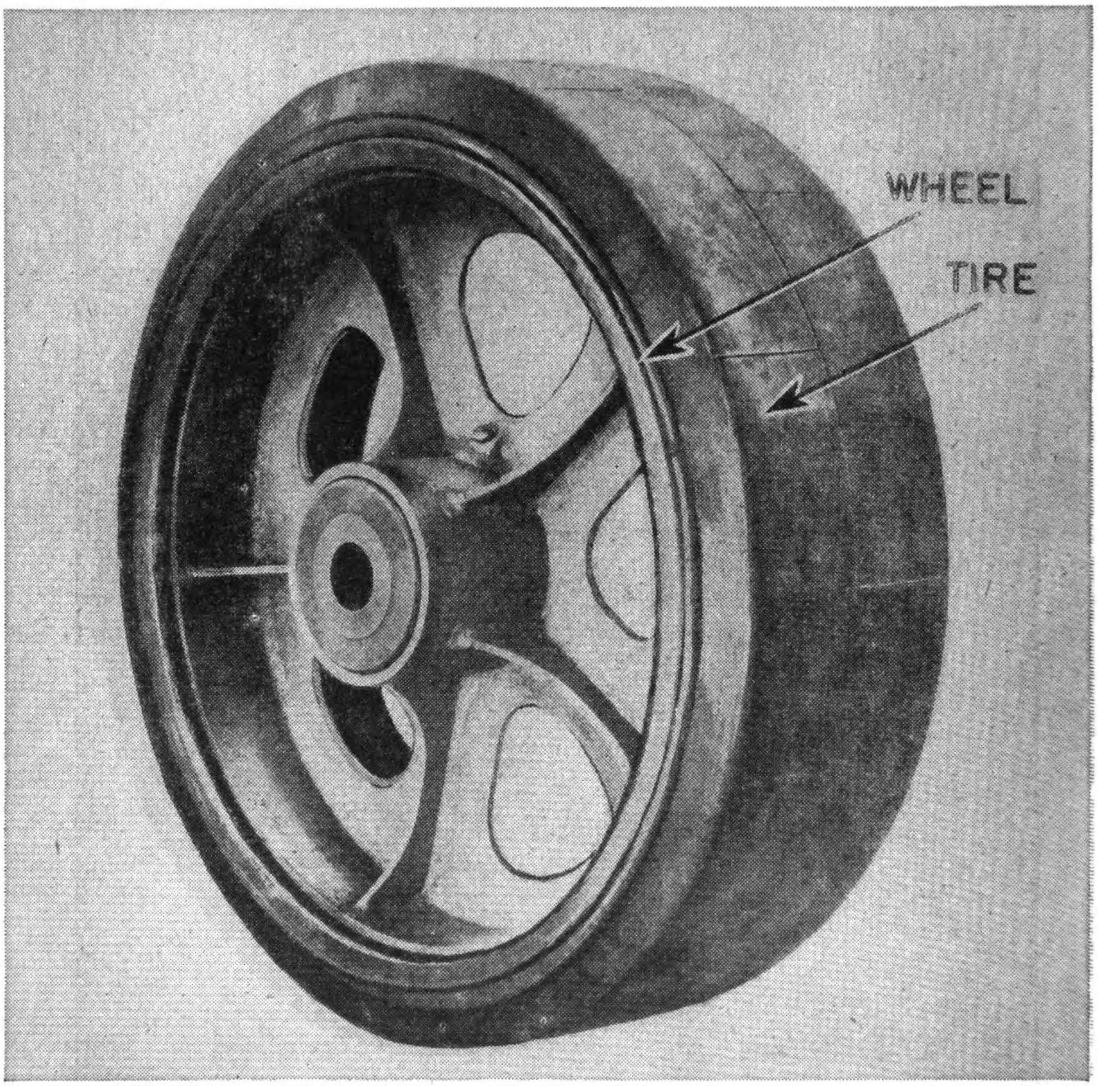


FIGURE 90.—Bogie wheel with rubber tire.

nections to cut or gouge the tire on the bogie wheel. The tension can be changed by adjusting the idler wheel.

48. Dismounting and mounting full tracks.—*a. Dismounting.*—Release the track tension by means of the eccentric idler shaft. Remove the inside and outside end connections by removing the nuts and wedges (fig. 88). The most convenient place to disconnect the link is just below the driving sprocket (fig. 87). Lay the track flat on the ground and move the vehicle off.

b. Mounting.—Reverse the above procedure.

c. Details.—For complete details of these procedures see TM 9-725 and 9-750.

49. Care of bogie wheels.—The bogie wheels, which carry the weight of the vehicle and ride on the track, have pressed-on solid rubber tires (fig. 90).

a. Be especially careful when lubricating the bogie assemblies to keep bogie wheels and other rubber parts free from oil and grease.

b. Do not permit foreign matter such as stones, sticks, wire, dirt, and grass to remain lodged in the rubber or between the bogie wheels and supporting arms.

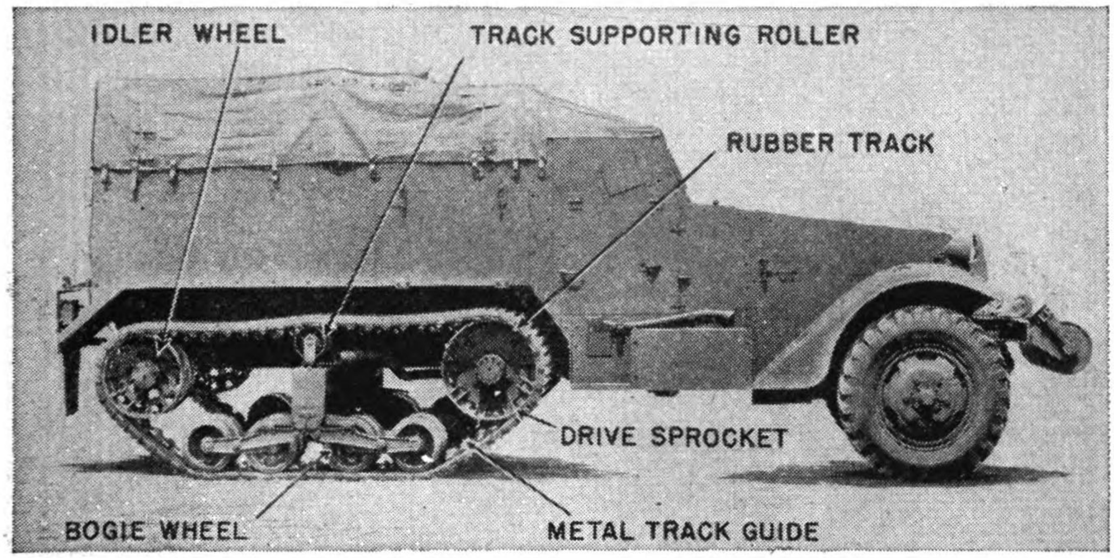


FIGURE 91.—Car, half-track.

c. When a bogie wheel requires a new rubber tire, replace the entire wheel.

(1) Raise bogie wheel on jack or lift. Remove the cotter pin and nut from the back of the bogie wheel gudgeon (fig. 89).

(2) Drive out the gudgeon. The wheel can then be lifted out and a new one inserted, reversing the procedure above.

(3) Send the old wheel to the proper personnel for replacement of the rubber tire.

50. Salvaging track blocks.—Turn in the entire block with the rubber for reclamation.

51. Half-track vehicles.—*a.* Half-track vehicles are wheeled vehicles in which the rear (driving) wheels have been replaced by track-laying mechanisms (fig. 91). Unlike full tracks, they are at present nonreversible. Each of the two tracks on a half-track

vehicle is an endless band constructed of rubber, molded around a reinforcing skeleton of steel cables and steel bars. Metal track guide vanes, bolted along the inner centerline of the track (fig. 92) engage with the drive sprocket teeth. On half-track vehicles, bogie wheels are bolted to each side of the bogie hub and flange (figs. 93 and 94). The hub and flanges form a groove between the two wheels to clear the track guides and to protect the tires from the guide vanes (fig. 92).

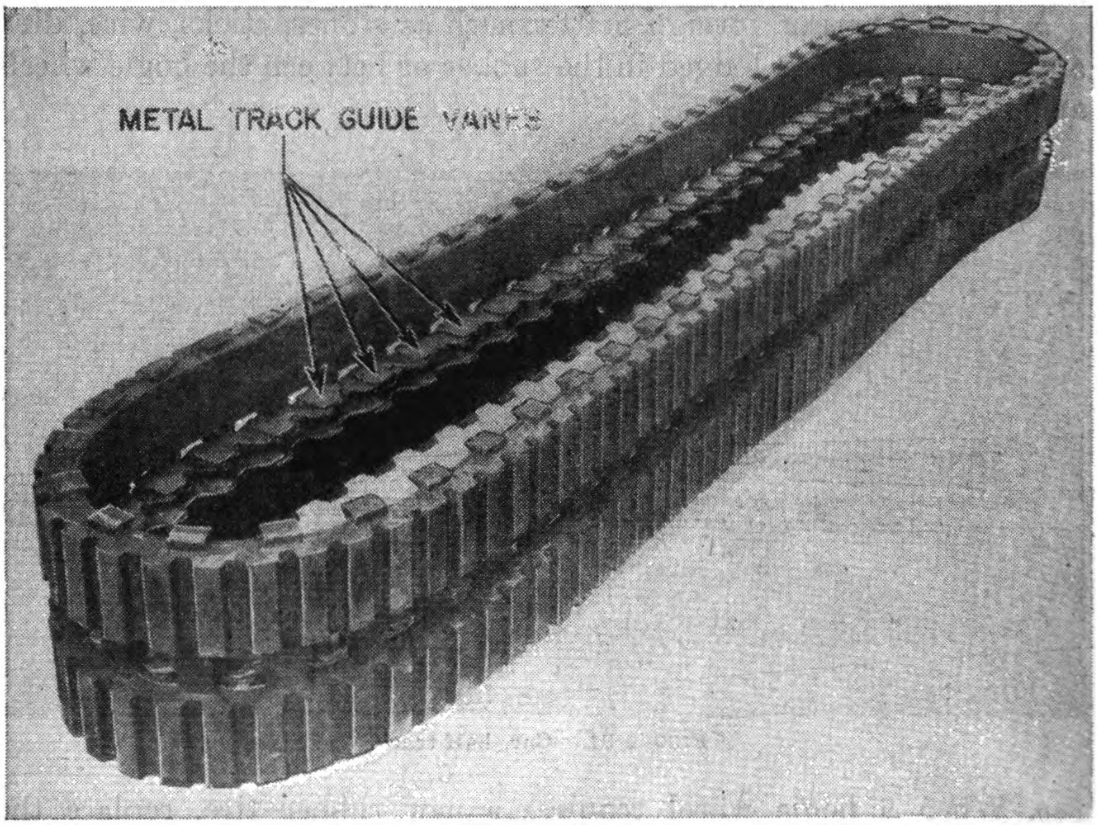


FIGURE 92.—Track for half-track vehicle.

b. To replace bogie wheels on half-track vehicles, jack up the vehicle, reduce tension on the track, remove the wheel gudgeon (fig. 95), and lift out the bogie wheel assembly. Remove the wheel from the flange, and install a new wheel by reversing this procedure.

c. The tire is cured on the wheel. Return this old tire and wheel to the proper personnel for replacement of the rubber tire.

52. Dismounting and mounting tracks on half-track vehicles.—*a. Dismounting.*—Jack up the vehicle so all the bogie wheels on one side are 5 or 6 inches off the ground. Reduce tension on track. Remove the idler wheel flange (fig. 95). Lift track off idler wheel, track supporting roller and driving sprocket wheel and remove the track.

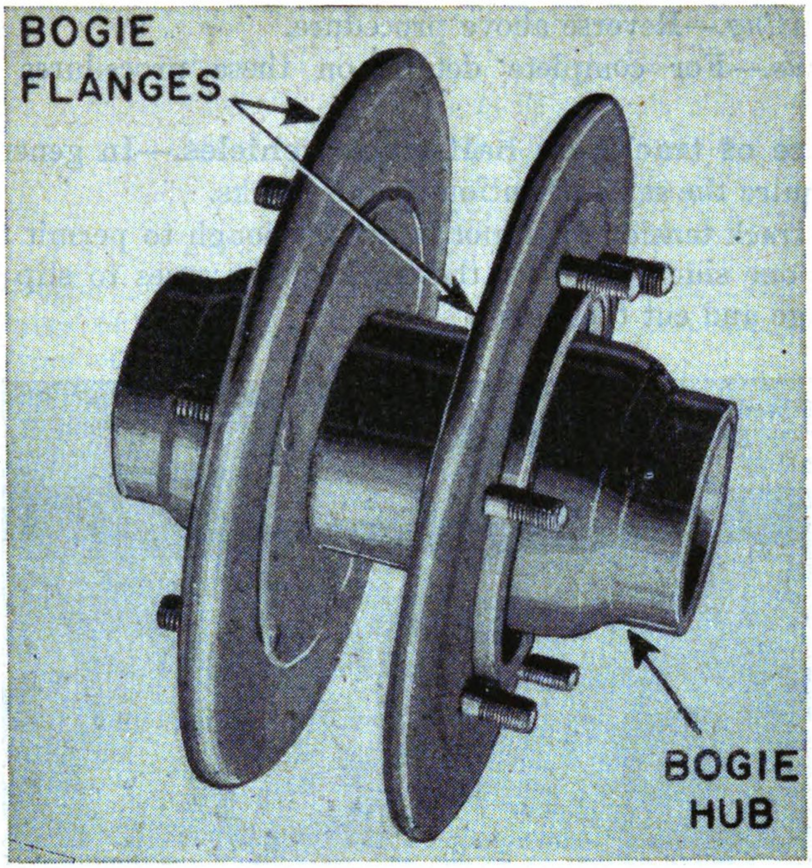
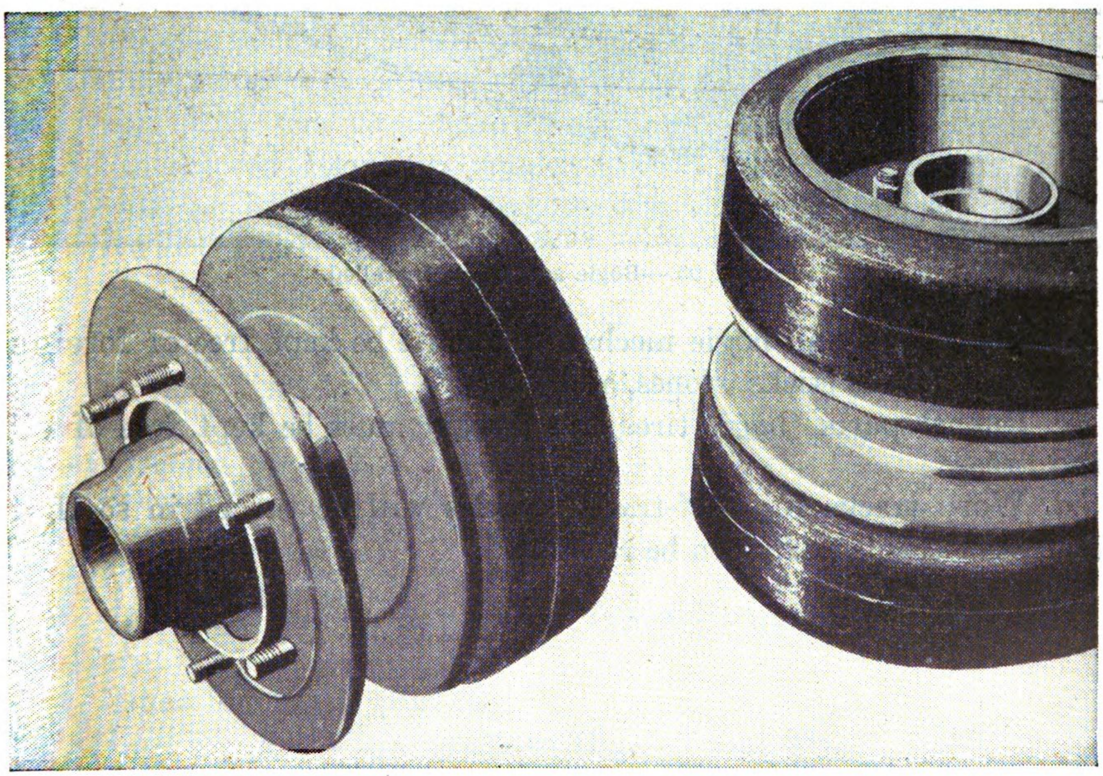


FIGURE 93.—Bogie hub and flanges.



① One wheel mounted. ② Two wheels mounted.

FIGURE 94.—Bogie wheels mounted on bogie hubs and flanges.

b. Mounting.—Reverse above procedure.

c. Details.—For complete details on these procedures see TM 9–710.

53. Care of tracks on half-track vehicles.—In general, these tracks require the same attention as full tracks.

a. The track tension must not be loose enough to permit the track to slip to one side and allow the track guide vanes to slip over the bogie flange and cut the tires.

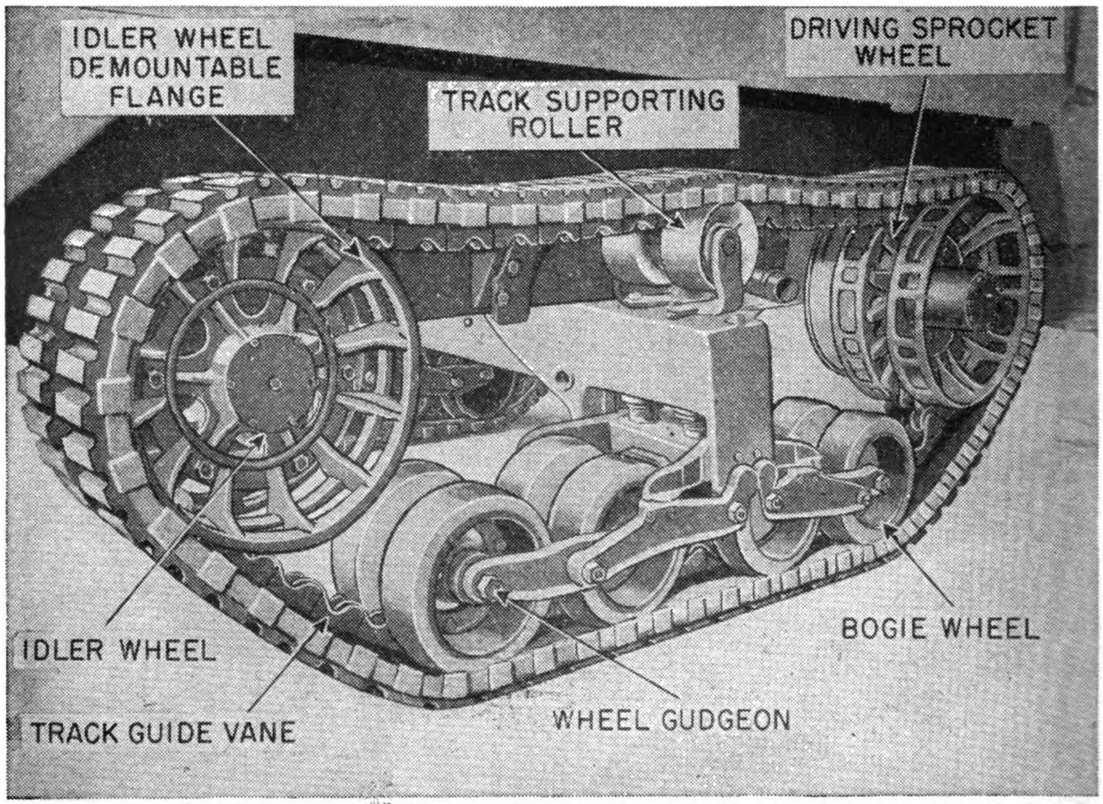


FIGURE 95.—Bogie and track, installed.

b. The tracks and bogie mechanisms must be kept free of foreign material, such as sticks, stones, and wires.

c. Rubber parts (bogie tires and tracks) must be kept free of oil and grease.

d. Worn tracks for half-track vehicles will be turned in so that their serviceable parts can be reclaimed.

Chapter 3

AIRCRAFT

Section I

GENERAL

54. General.—*a.* The service procedure for airplane tires and tubes, while basically the same as that used on cars and trucks, must be more rigidly enforced and followed, not only to assure adequate tire performance, but also to avoid costly accidents resulting from tire failure.

b. Auxiliary wheels refer to the small tail or nose wheels, and main landing wheels to the large wheels that carry most of its load.

c. Balance marks appear on certain aircraft tubes to indicate the heavy portion of the tube. These marks are approximately ½ inch wide by 2 inches long, and are visible when the bead is pushed off the rim ledge with the tire deflated. This balance mark should be placed at the red dot on the tire to balance the tire assembly. On tubes with no balance mark, balance the tire assembly by placing the valve at the red dot on the tire.

Section II

TYPES OF TIRES

55. General.—*a.* There are four types of tires in general use on airplanes:

Smooth contour (fig. 96).
Low and extra low pressure (figs. 97 and 98).
High pressure (fig. 99).
Streamline (fig. 100).

b. Streamline and smooth contour tires, specification Nos. 26531, 26545, and 26547, have a deflection rib or marker on both shoulders of the tire as shown in figures 96 and 100. These ribs indicate the correct amount of air pressure. Correct pressure depends upon the

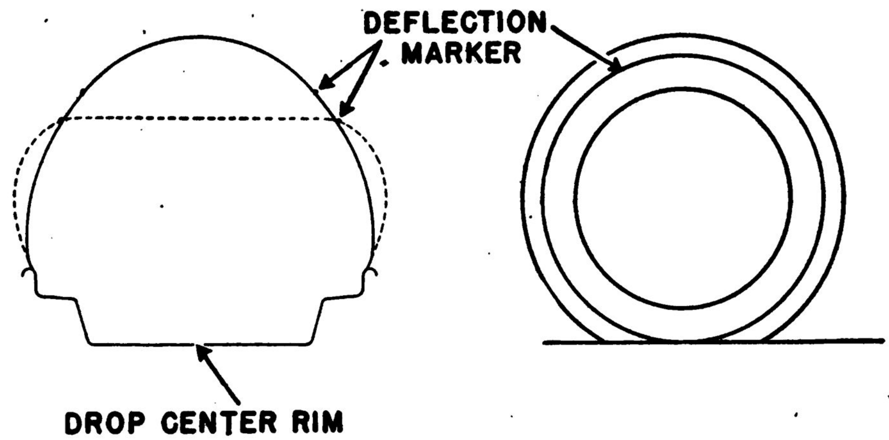


FIGURE 96.—Smooth contour tire.

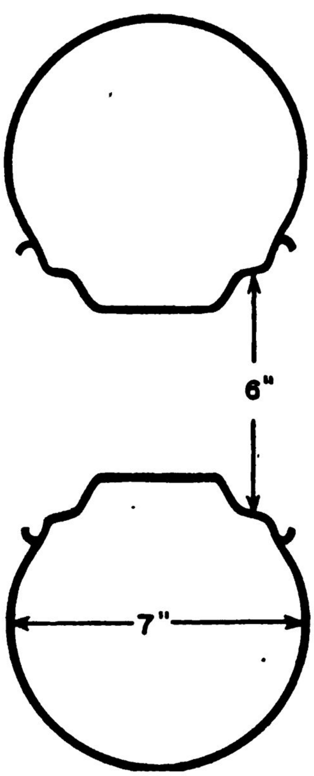


FIGURE 97.—Low pressure tire, size 7.00–6.

static load on the tire which will vary according to the military load and the plane. To obtain the correct inflation in these tires, use the deflection ribs as a guide and inflate or deflate until they are visible at the edges of the tire contact with the ground. The dotted lines show the correct deflection when the tire is properly inflated.

56. Smooth contour tire.—Figure 96 shows the smooth contour airplane tires which are being used for both landing and auxiliary wheels.

57. Low pressure tires.—Figure 97 shows the contour of a low pressure tire, used on landing and auxiliary wheels. This type of tire is made with both a smooth and nonskid tread. Figure 98

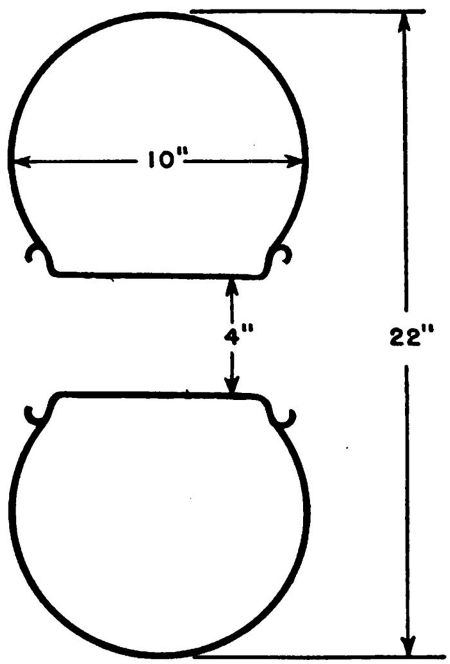


FIGURE 98.—Extra low pressure tire, size 22 x 10–4.

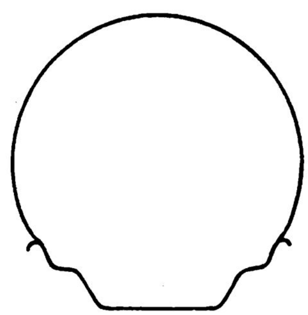
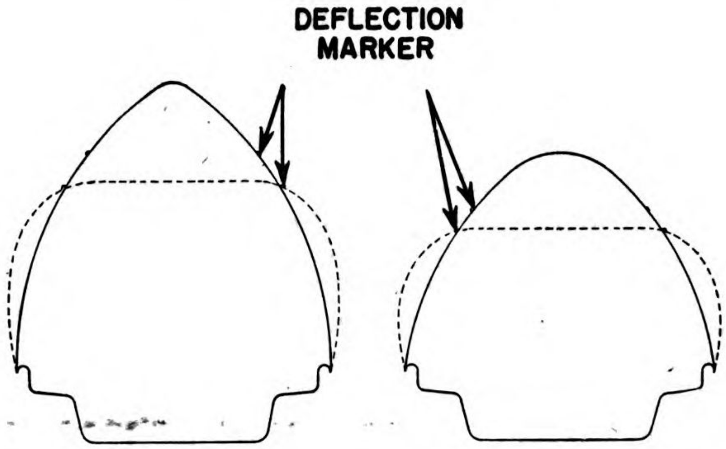


FIGURE 99.—High pressure tire.

shows the contour of an extra low pressure tire, sometimes used on both landing and auxiliary wheels, which has large sections with small rim diameters.

58. High pressure tires.—Figure 99 shows the contour of a high pressure tire which is made with either a smooth or a nonskid tread and is used only on main landing wheels.

59. Streamlined tires.—Streamlined tires (fig. 100) are used on both landing and auxiliary wheels. This type of tire is being rapidly replaced with the smooth contour tire (fig. 96).



① Pointed tread ② Round tread.

FIGURE 100.—Streamline tire.

SECTION III

TYPES OF WHEELS

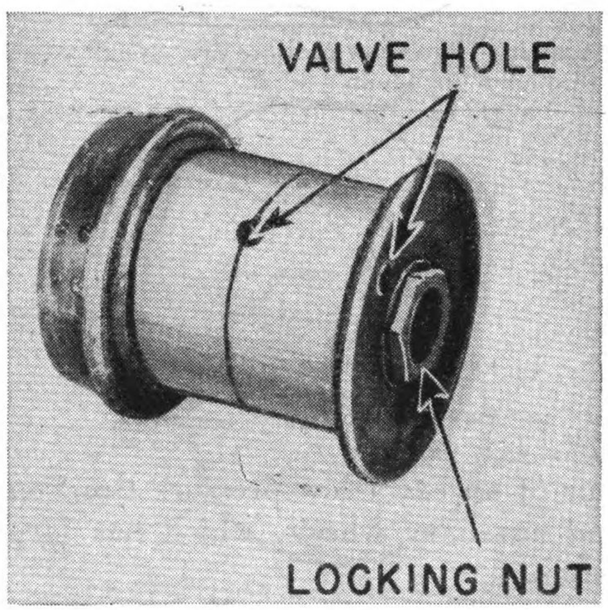


FIGURE 101.—Split wheel, assembled.

60. General.—Airplane wheels fall into four general types: split wheels (fig. 101); drop-center wheel with removable side flange (fig. 104); drop-center wheel with nonremovable side flange (fig. 106); and flat-base wheel with removable side flange (fig. 107).

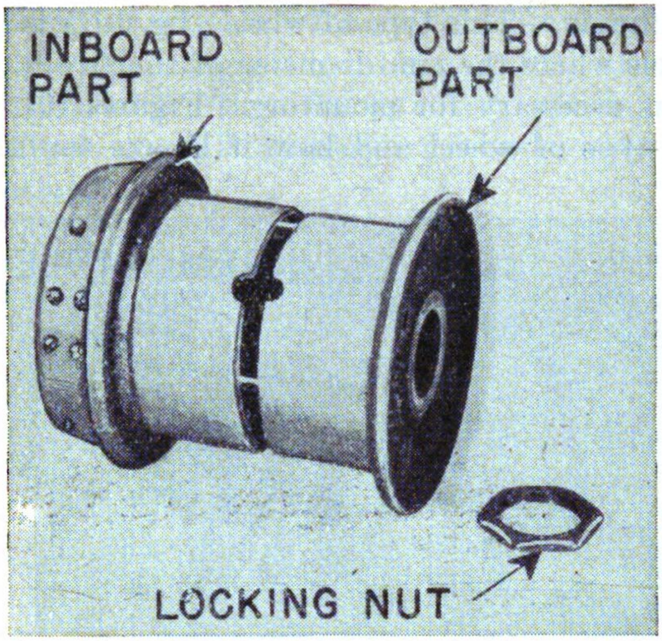


FIGURE 102.—Split wheel, locking nut removed.

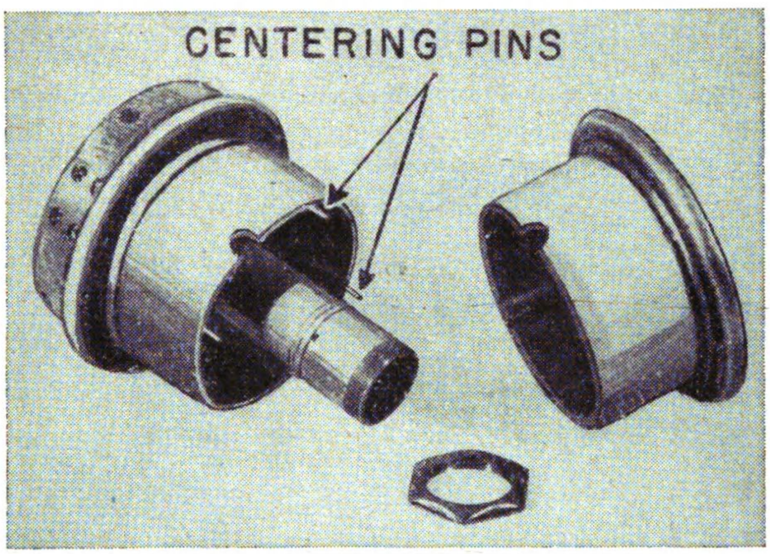


FIGURE 103.—Split wheel, disassembled.

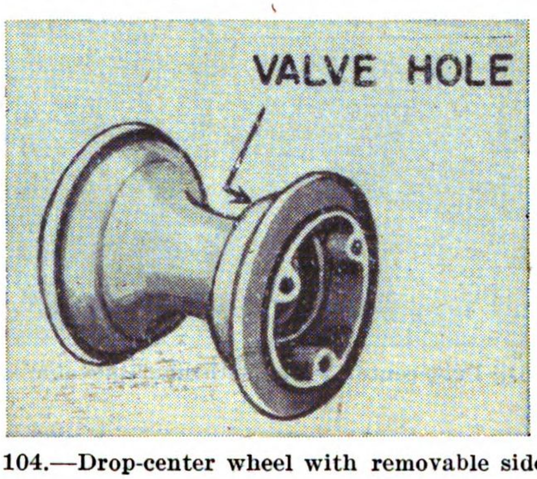


FIGURE 104.—Drop-center wheel with removable side flange.

61. Split wheels.—This type of wheel (fig. 101) is being used on auxiliary wheels where the rim diameter of the tire is so small that the split rim is necessary for mounting. Figures 101, 102, and 103 illustrate this type of wheel and how it breaks for tire mounting.

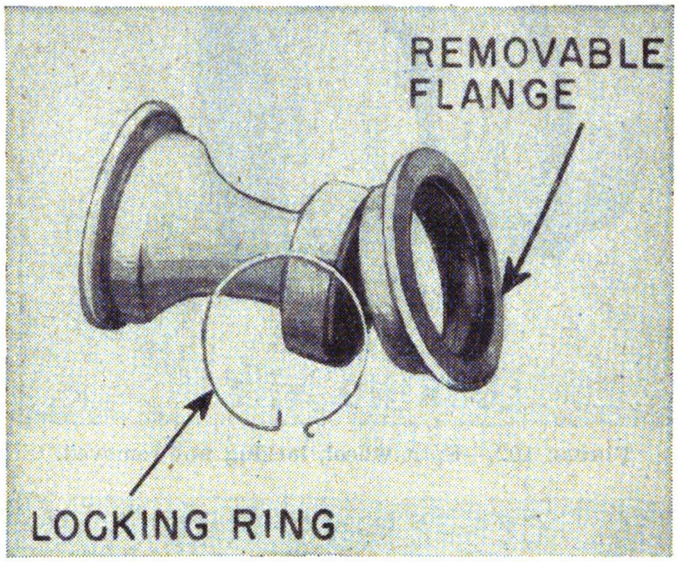


FIGURE 105.—Drop-center wheel with removable side flange, disassembled.

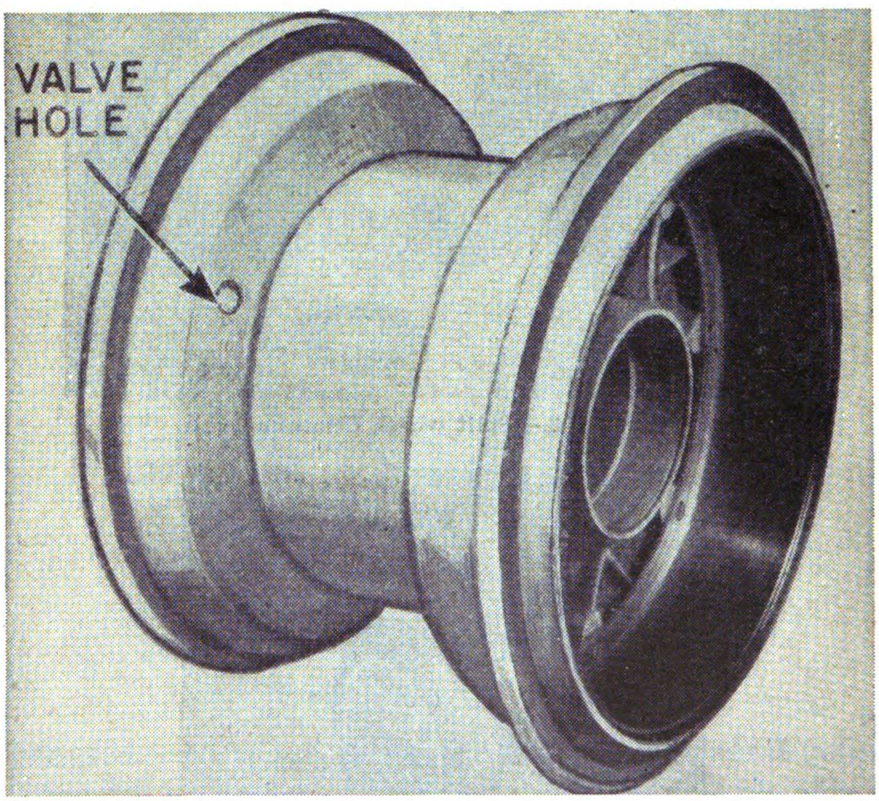


FIGURE 106.—Drop-center wheel with nonremovable side flange.

62. Drop-center wheels with removable side flange.—Wheels with removable side flanges (figs. 104 and 105) are being used with the small rim diameter tires for auxiliary wheels, tail wheels particularly. These are full drop-center wheels which make for ease of tire mounting.

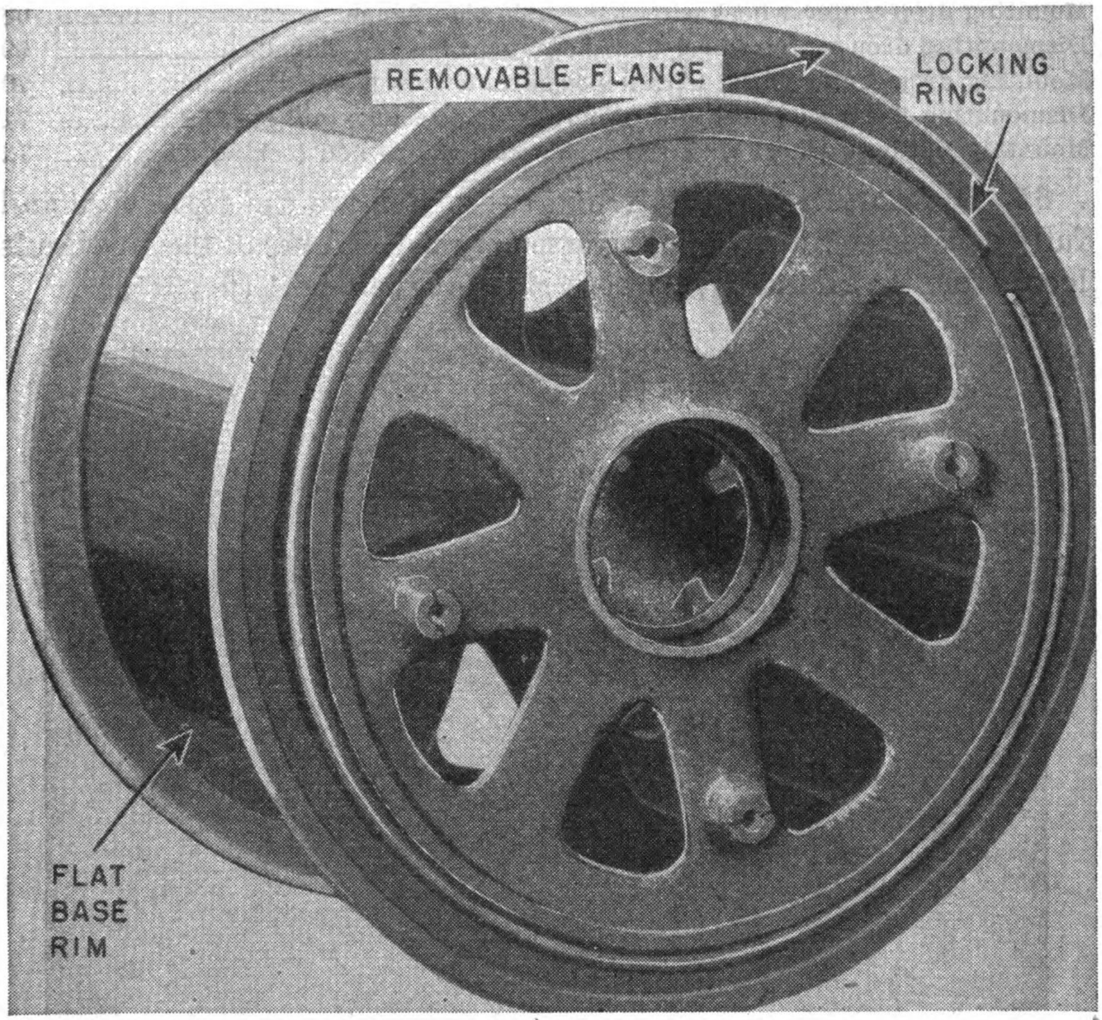


FIGURE 107.—Flat base wheel with removable side flange and locking ring.

63. Drop-center wheels with nonremovable side flange.—The integral type of drop-center wheel (fig. 106) used chiefly for the intermediate airplane tire sizes. There are no removable parts to this type of wheel.

64. Flat base wheel with removable side flange and locking ring.—This wheel (fig. 107) is used with tires which have beads so stiff that it is extremely difficult to mount them on drop center wheels.

Section IV

MOUNTING AND DISMOUNTING TIRES

65. Dismounting split wheels.—*a.* Remove the valve core and fully deflate the tube. Lay the assembly flat and break the tire beads loose from the rim flange on both sides of the wheel (fig. 108).

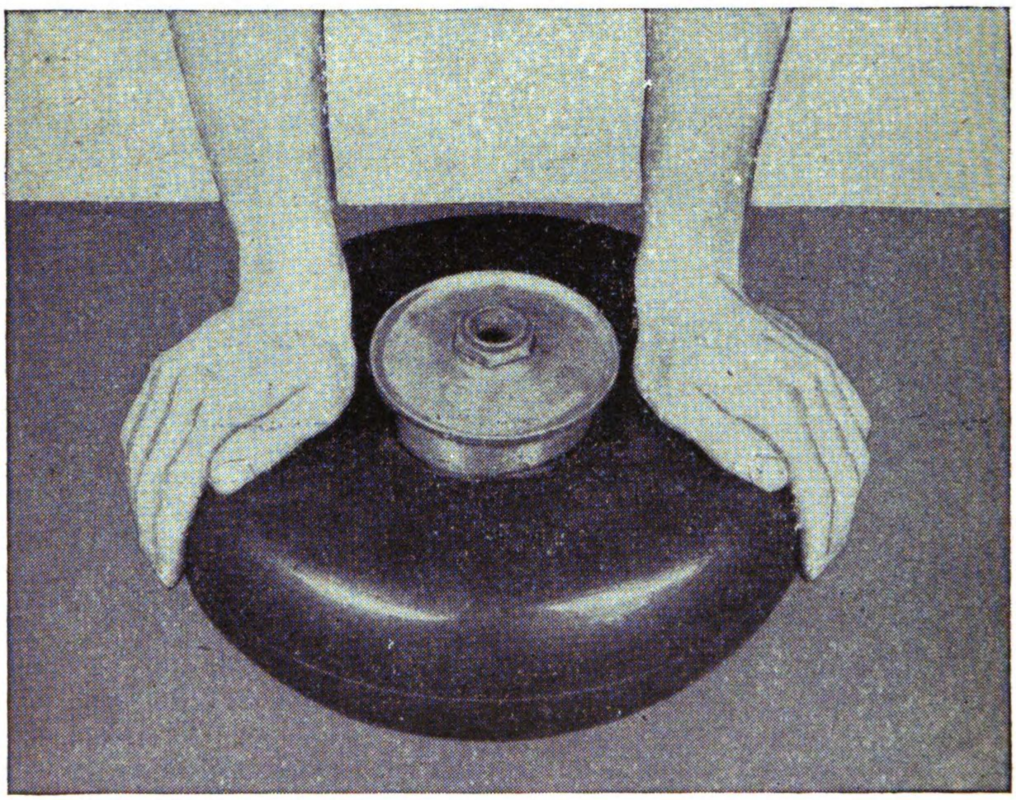


Figure 108.

b. Remove the locking nut from the wheel and remove both parts of the wheel from the tire (fig. 109).

66. Mounting split wheels.—*a.* Figure 110 shows the tire, tube, and wheel ready for assembly. Inspect the tire inside and outside for cuts, nails, glass, etc. The inside must also be free from any foreign material such as sand or dirt. Test the tube to make sure it does not leak.

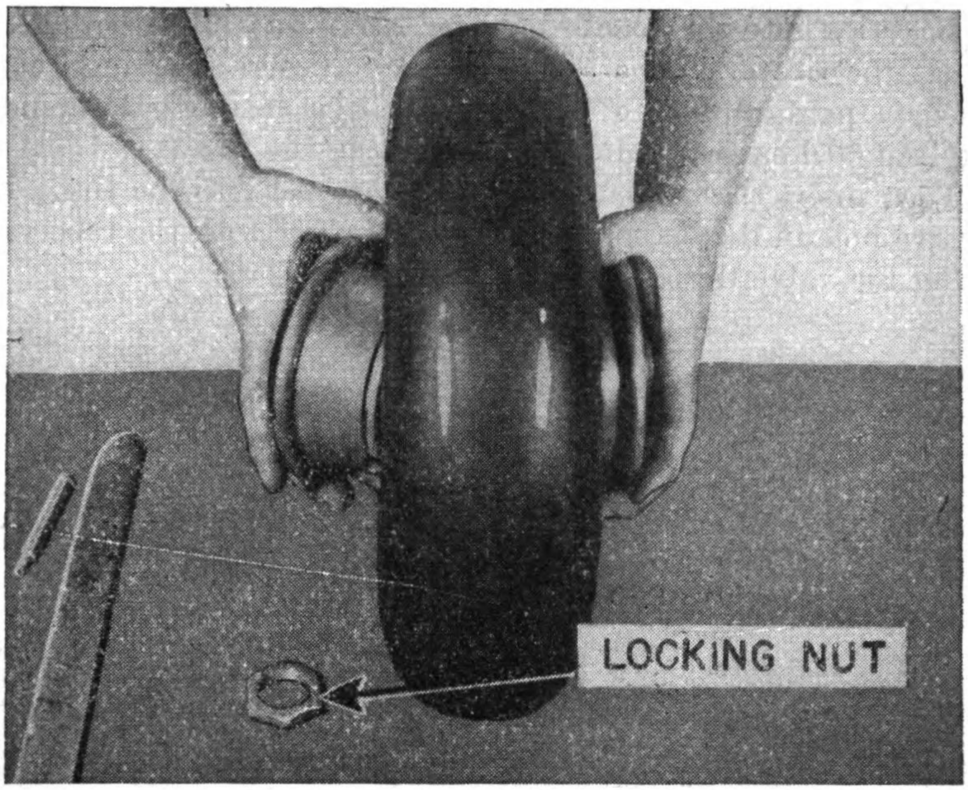


FIGURE 109.

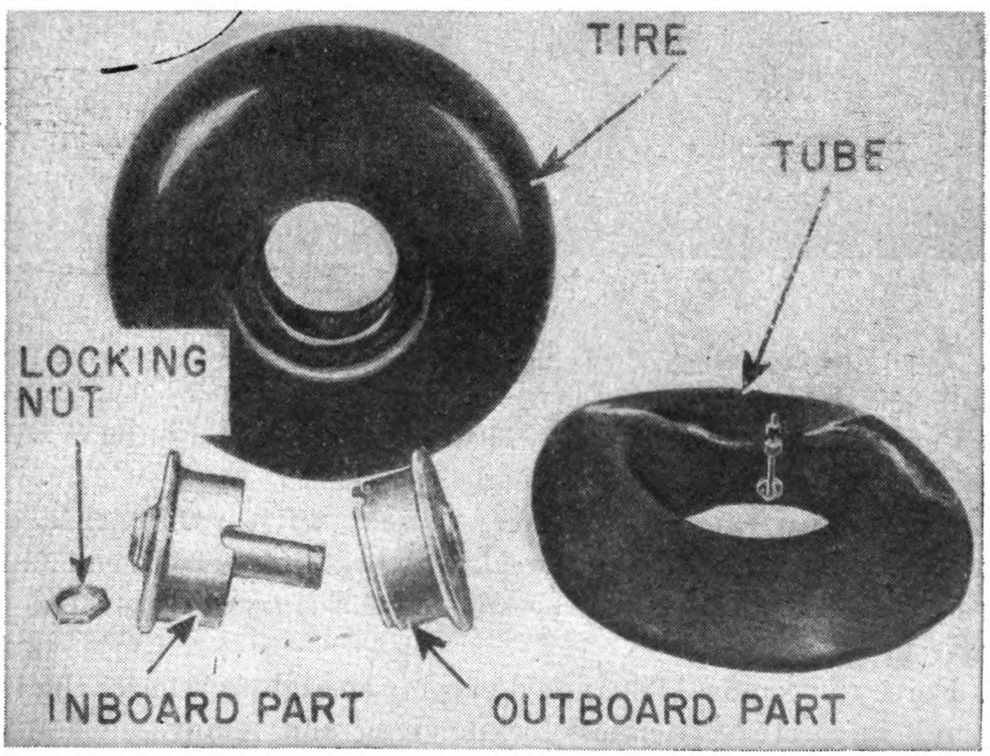


FIGURE 110.

b. Figure 111 shows that the tube is fully deflated and folded for easy insertion into this small diameter tire. Care must be taken to see that the tire and tube are mounted for correct balance, as explained in paragraph 54*c*. After the tube is inserted it should be barely rounded out with air before mounting the tire.

c. Then insert the outboard part of the wheel into the tire. Line the valve hole in the outboard part of the wheel with the tube valve, pushing the valve through the valve hole (fig. 112).

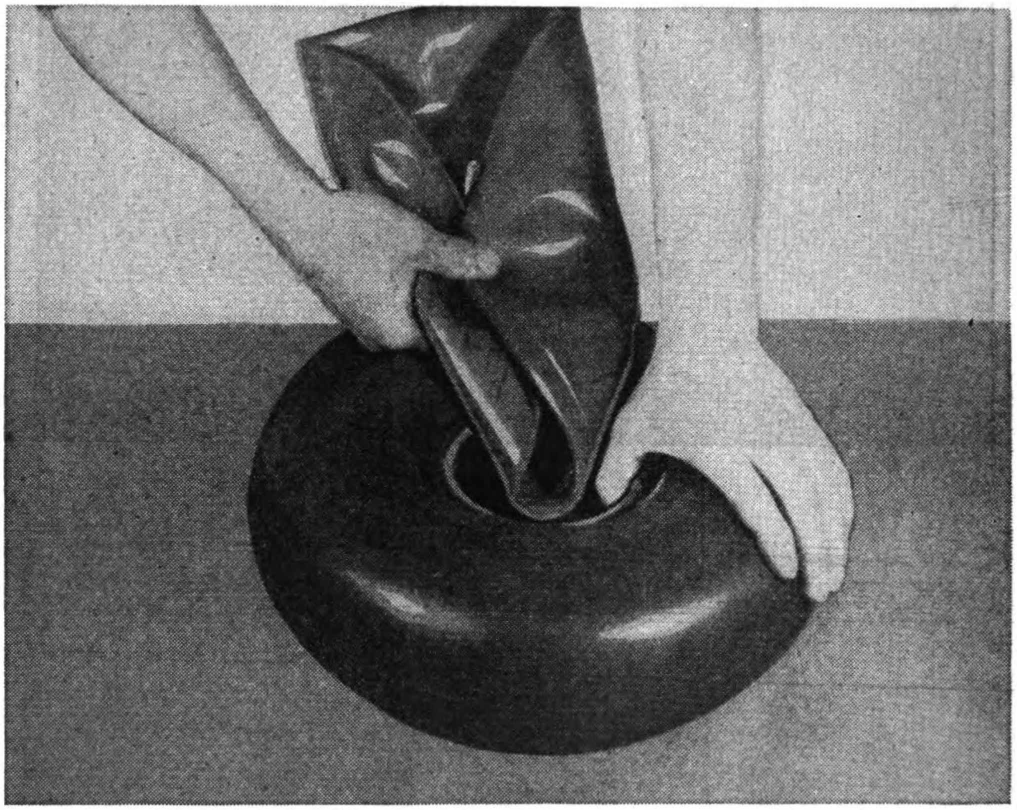


FIGURE 111.

d. Turn the assembly over, holding the valve in place and insert the inboard side of the wheel (fig. 113).

e. Put the locking nut on the wheel (fig. 114) and tighten it with a wrench. Inflate tire to recommended pressure.

67. Dismounting drop center wheel with removable side flange.—*a.* Lay wheel flat and break both beads loose from rim flanges and force the top bead into the well of the rim, as illustrated previously in figure 108.

b. Force the removable flange down far enough to remove the locking ring (fig. 115). Remove locking ring and removable flange.

c. Turn tire over and remove the rest of the wheel (fig. 116).

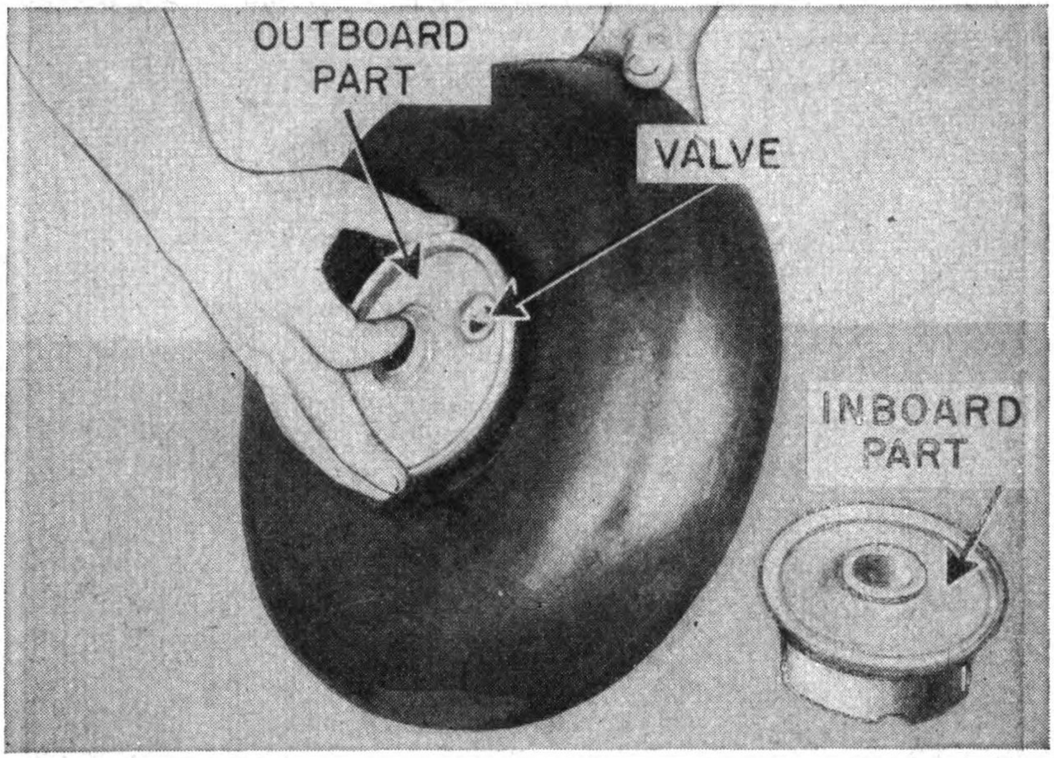


FIGURE 112.

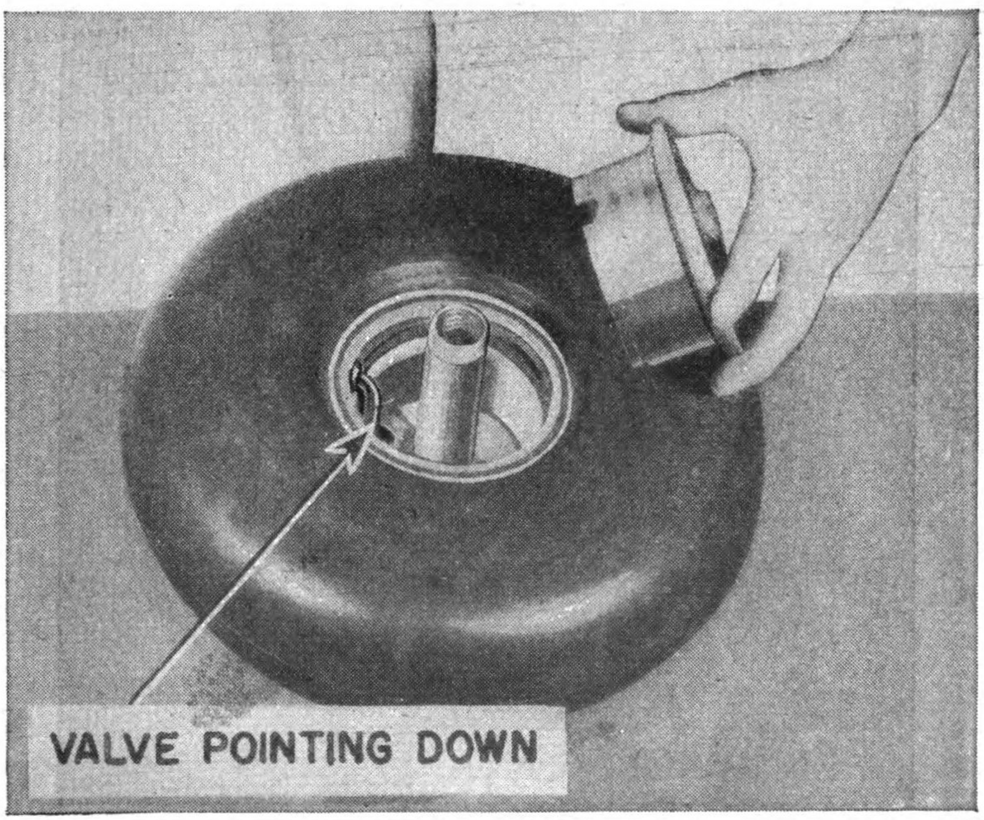


FIGURE 113.

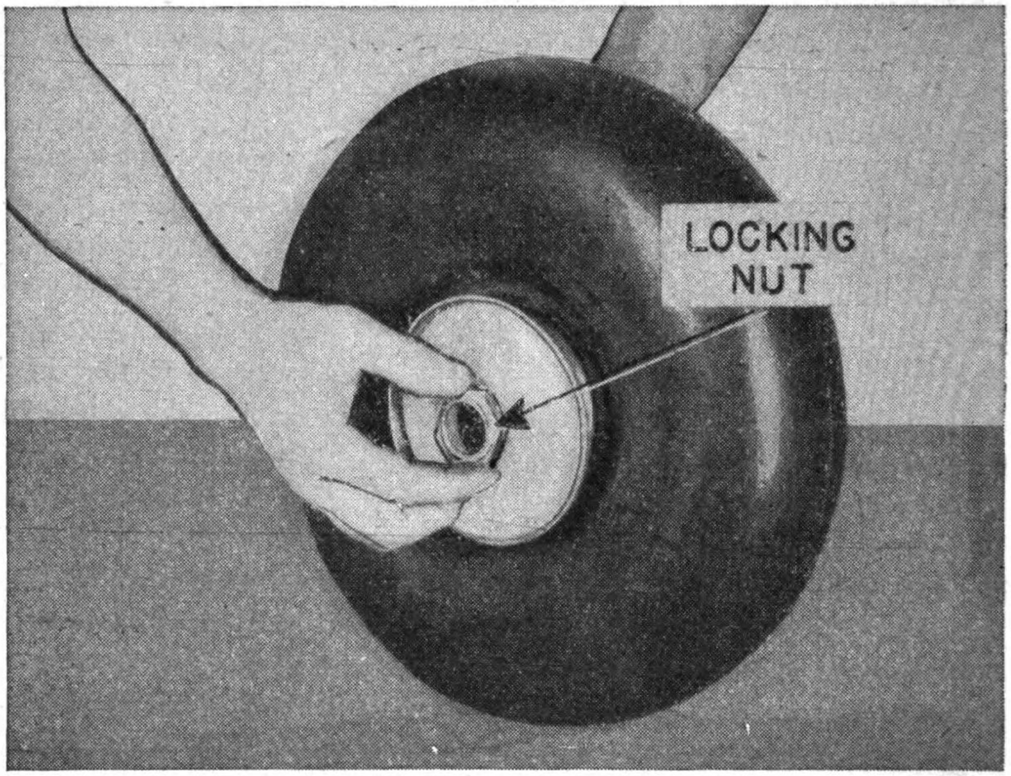


FIGURE 114.

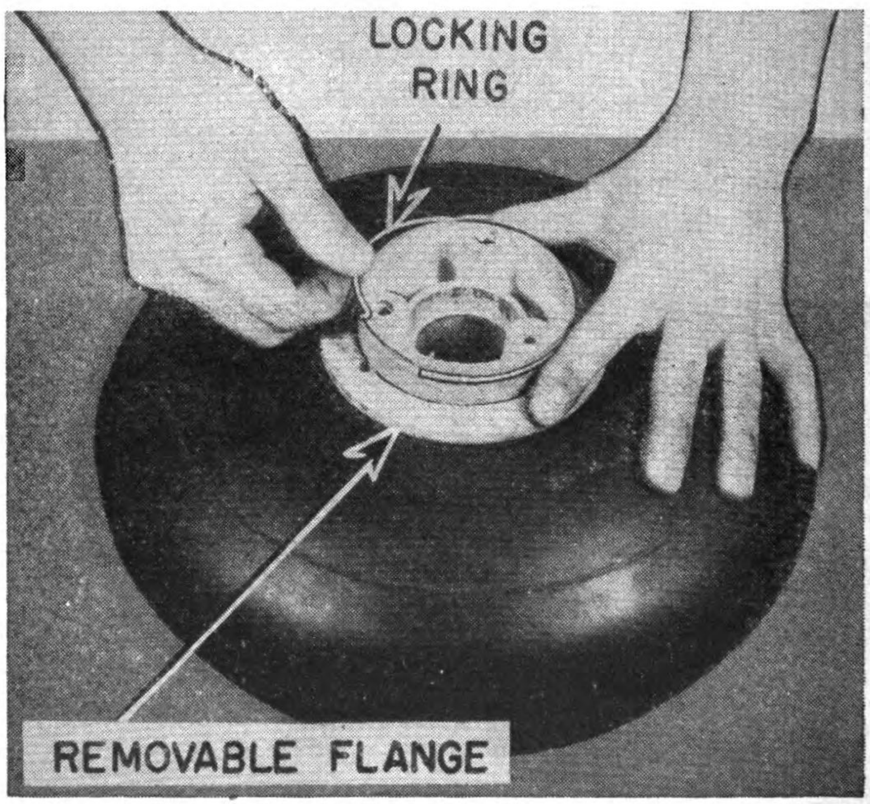


FIGURE 115.

68. Mounting drop-center wheel with removable side flange.—*a.* Figure 117 shows tire, tube, and wheel ready for assembly. Inspect the tire and tube as outlined in paragraph 66*a*. Insert the tube in tire as outlined in paragraph 66*b*. Make sure that the tire and tube are mounted for correct balance, as explained in paragraph 54*c*.

b. Insert the wheel into the tire (fig. 118), making certain that the valve hole is in line with the valve.

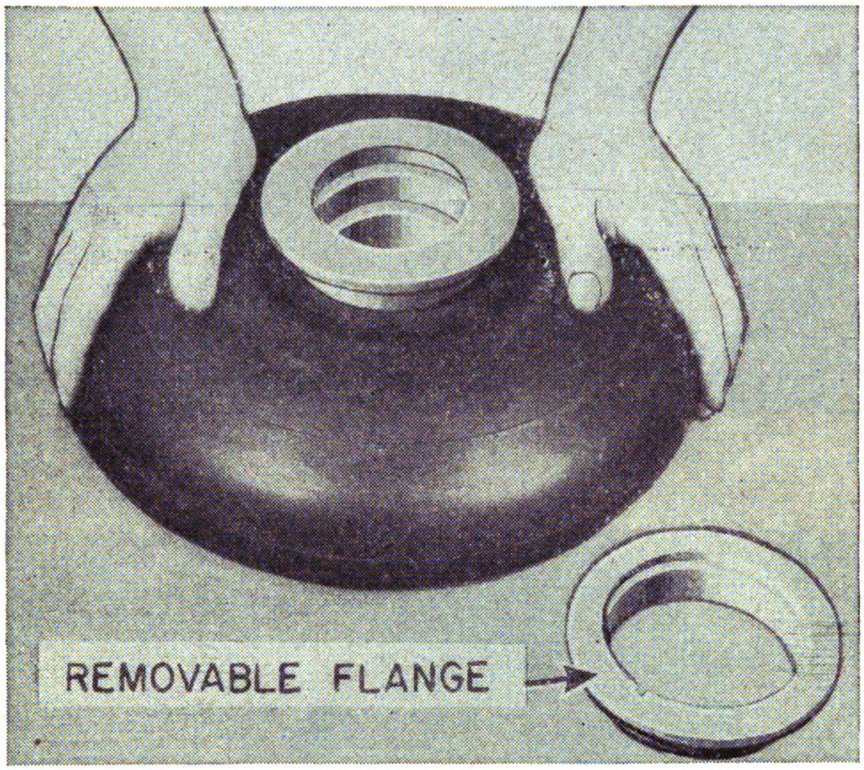


FIGURE 116.

c. Press the tire bead into the well of the wheel and work the tire valve into the valve hole. Place the valve extension (fig. 119) on the valve to hold it in place.

d. Place the removable flange on the wheel and insert the locking ring (fig. 120). Inflate tire slowly through valve extension to recommended pressure.

e. The tire should then be deflated and reinflated to relieve the pressure of any folds or buckles and to permit the tube to assume its proper contour within the casing. Remove valve extension.

69. Dismounting drop-center wheel with nonremovable side flange.—*a.* Dismounting a tire from this wheel is almost identical to taking a tire off the wheel of the present-day car. The first step, of course, is to fully deflate the tire by removing the valve cap and core.

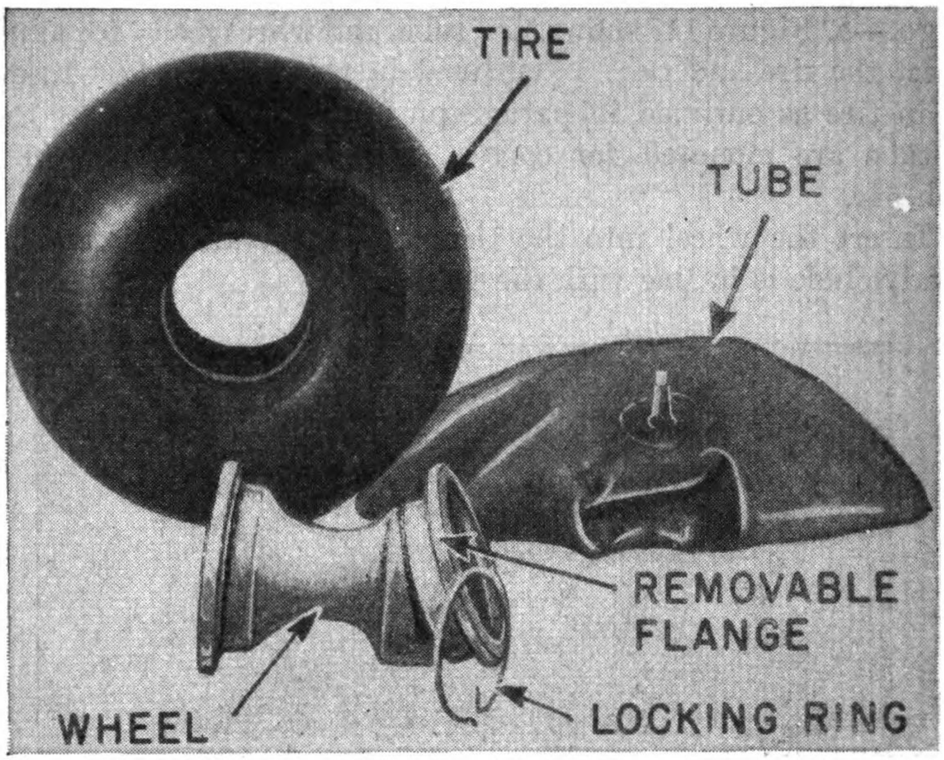


FIGURE 117.

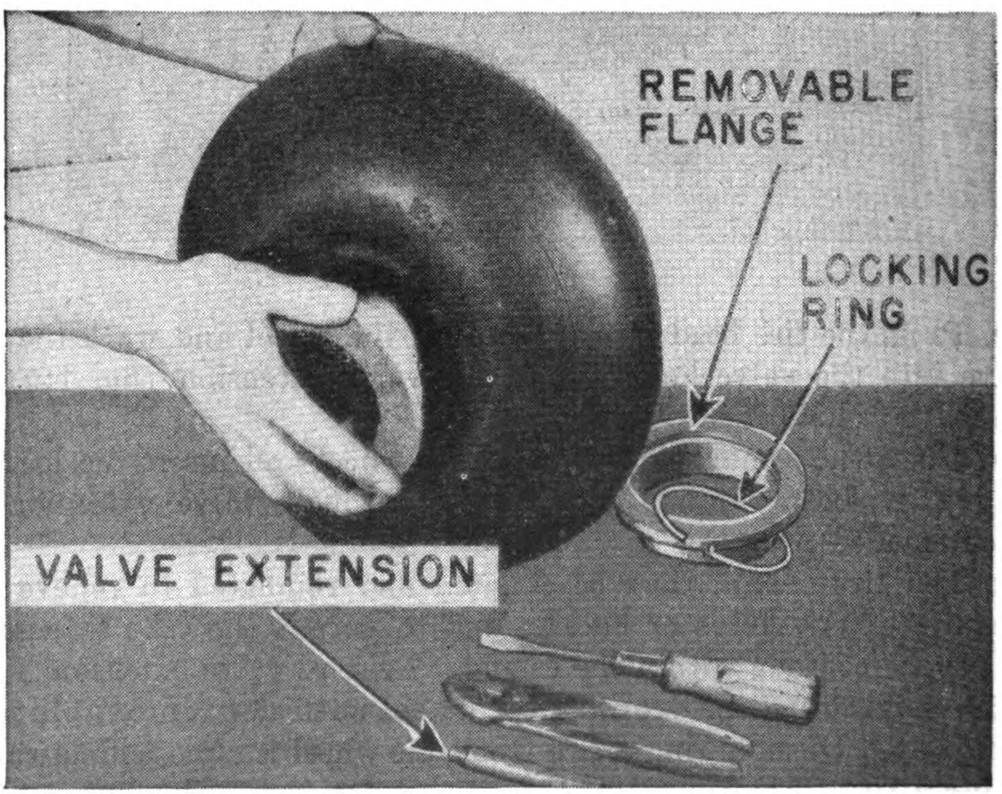


FIGURE 118.

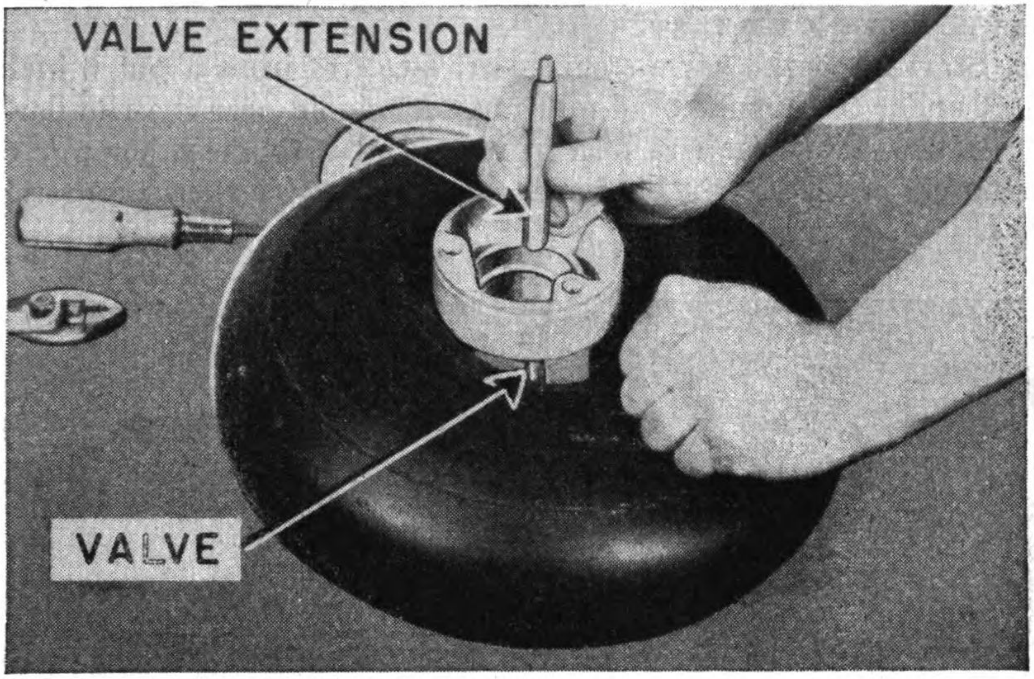


FIGURE 119.

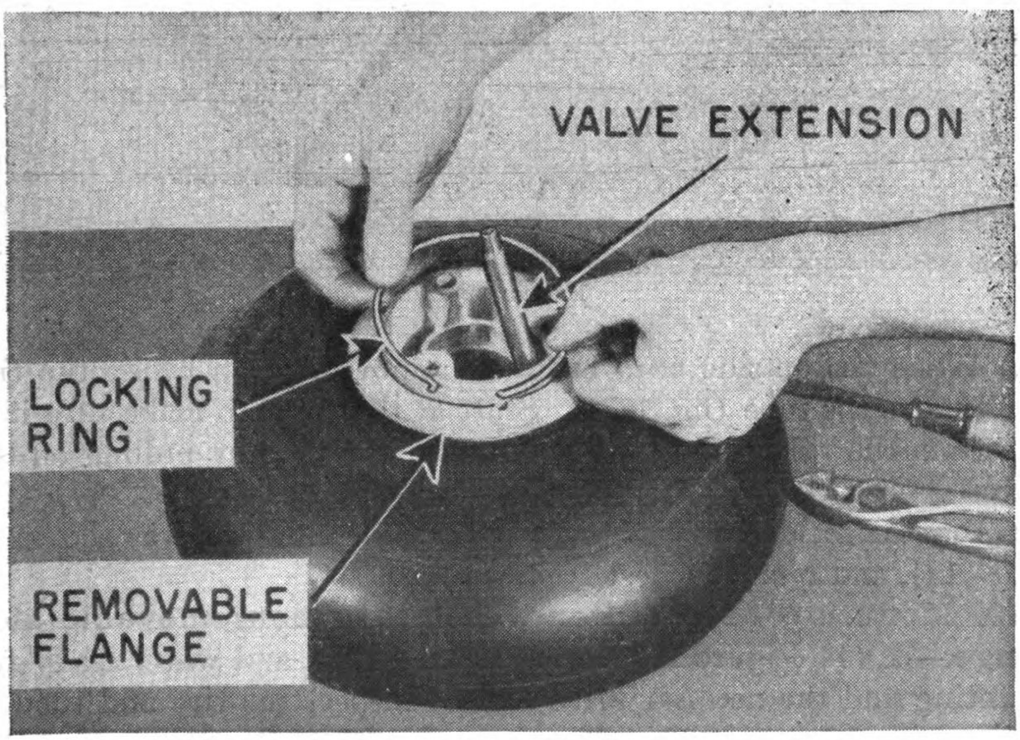


FIGURE 120.

b. Next, as shown in figure 121, break both beads loose from the rim flanges. Force as much of the outside bead as possible into the well opposite the valve.

c. Starting at the valve stem, insert two tire irons about 6 inches apart under the outside bead and force it up and over the rim flange (fig. 122). Hold one tire iron in place and with the other pry the remaining portion of the bead over the rim flange in short progressive steps.

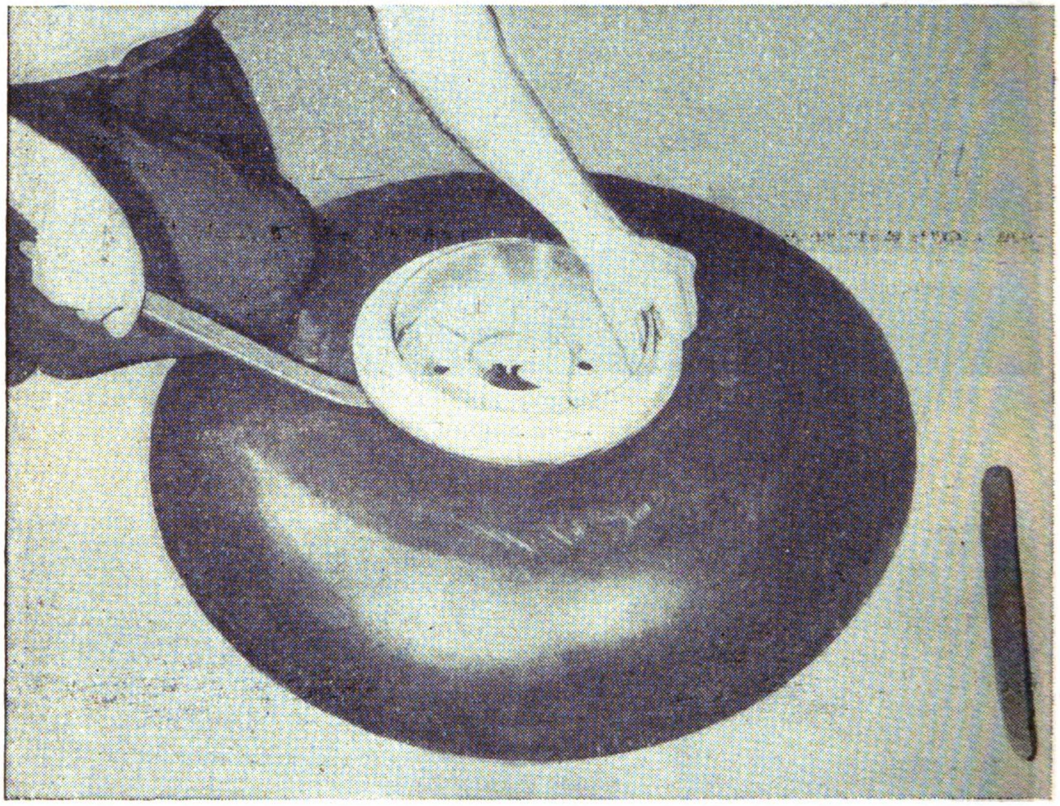


FIGURE 121.

d. When the outside bead has been removed, reach inside the tire and remove the tube (fig. 123). Start at the valve to make sure it is free from the valve hole. Do not remove the tube by pulling on the valve.

e. Pry the inside tire bead over the outside rim flange as shown in figure 124, and remove wheel from tire.

70. Mounting drop center wheel with nonremovable side flange.—*a.* (1) Figure 125 shows the tire, tube, and wheel ready for mounting and the necessary tire tools. Inspect the tire and tube as outlined in paragraph 66*a*. The tube should be barely rounded out with air before inserting it into the tire (fig. 125). The tire and

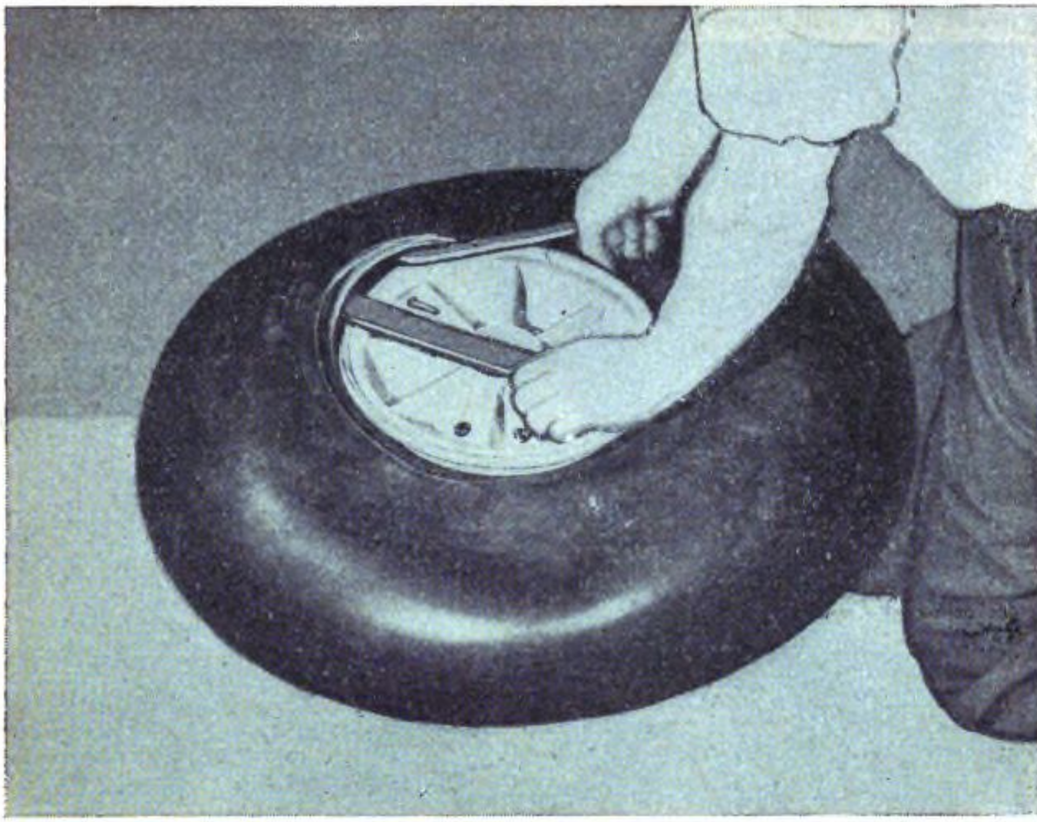


FIGURE 122.

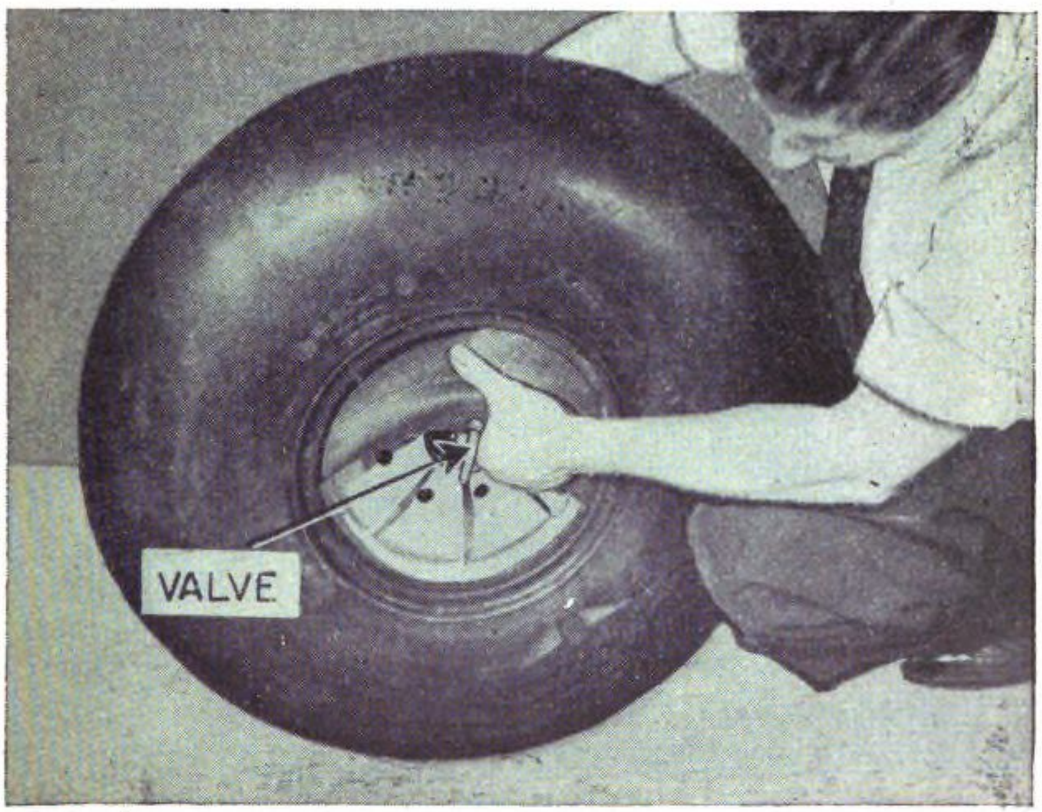


FIGURE 123.

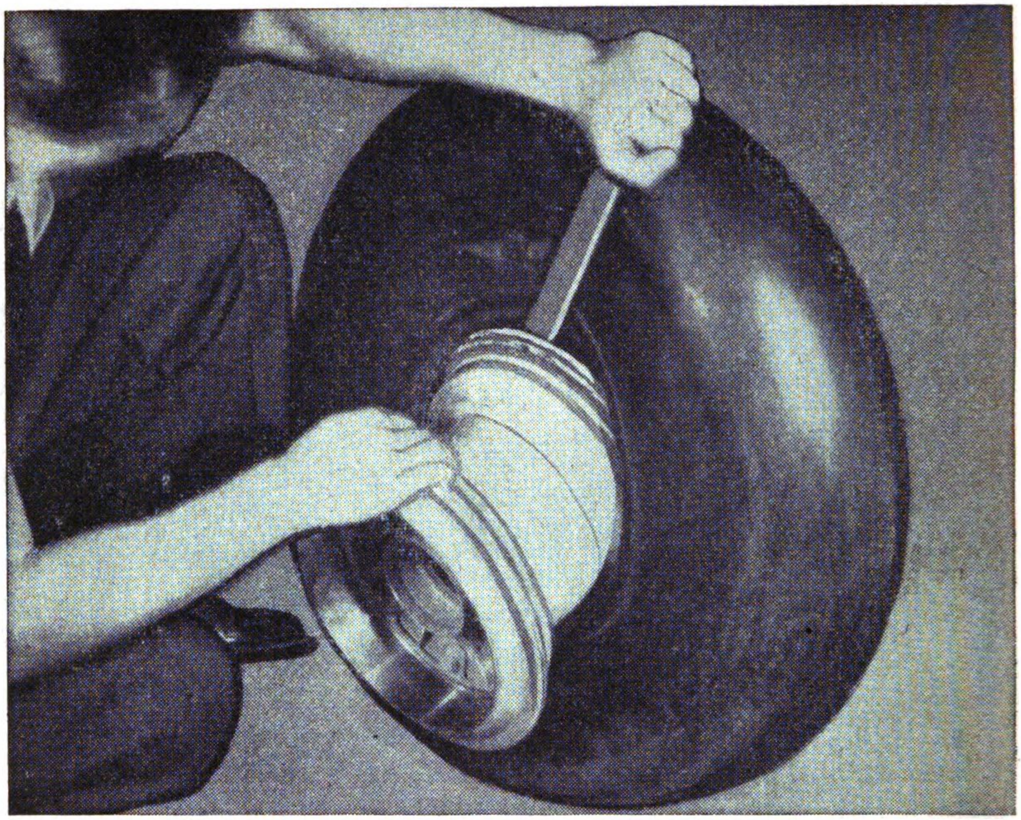


FIGURE 124.

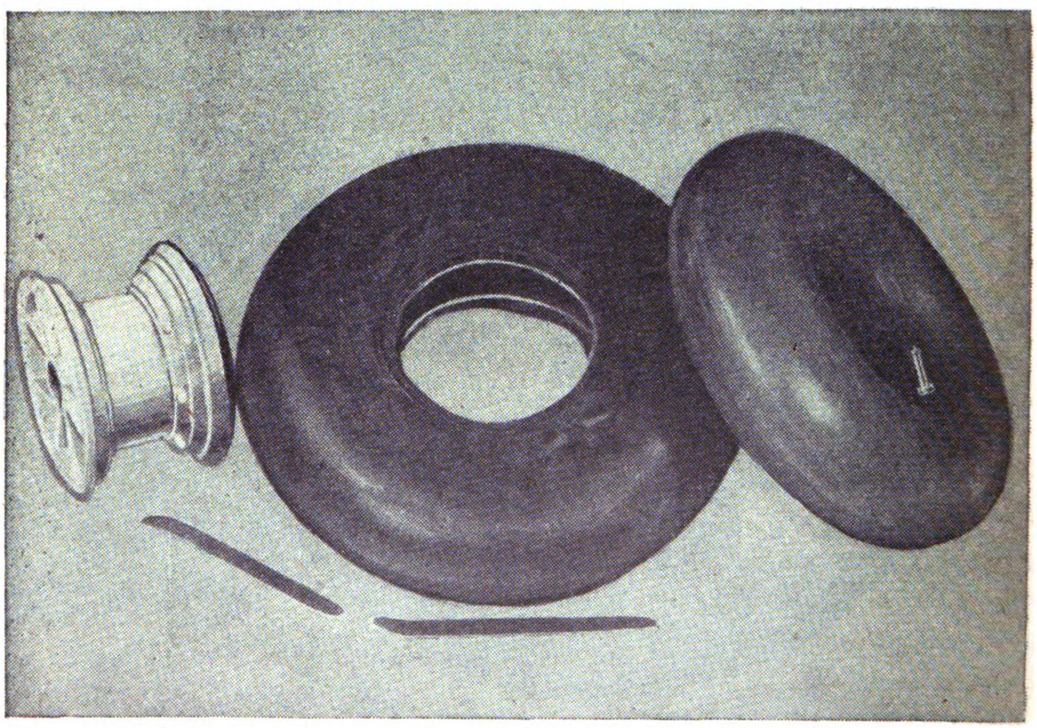


FIGURE 125.

tube should be mounted for correct balance, as explained in paragraph 54*c*.

Caution: The valve stem is off center on the tube and should be inserted so the offset is on the side of the valve hole.

(2) Dust the entire tube with powdered tire talc (specification 4–33, class 29).

b. Lay the wheel flat with the outside of the wheel containing the valve hole facing up. Line up the valve hole. Force one bead of the

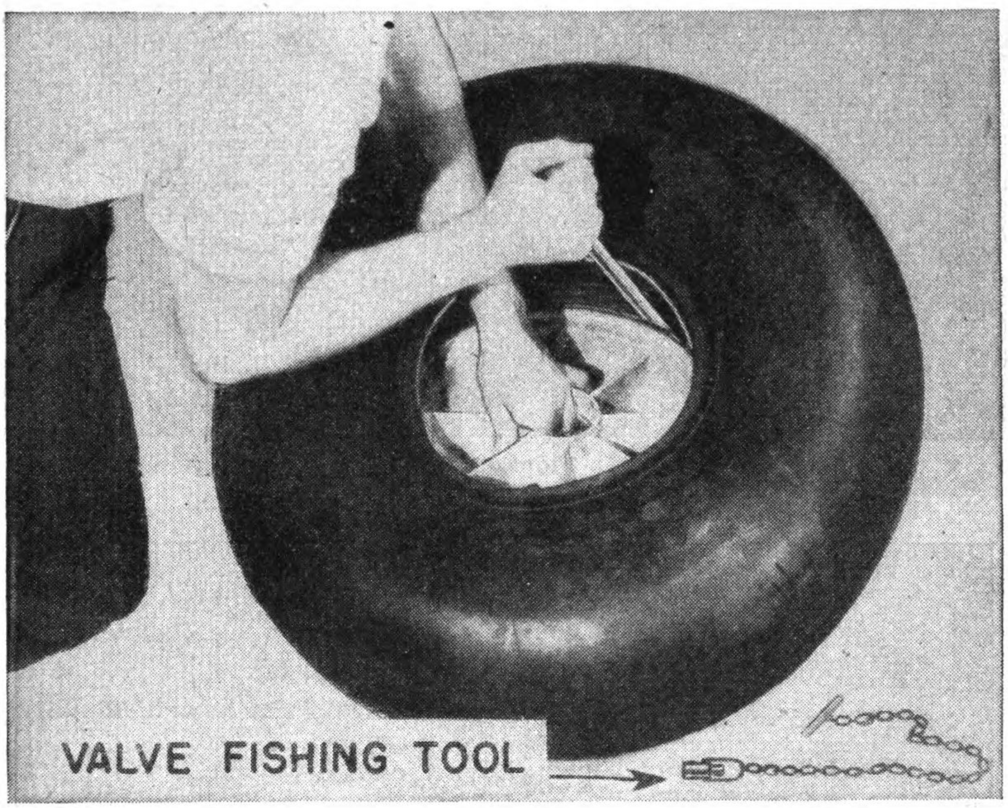


FIGURE 126.

tire over the flange. It may be necessary to use a tire iron for the last "bite" as shown in figure 126.

c. Pull the valve through the valve hole and attach a valve fishing tool (fig. 127) to make certain the valve does not drop back into the wheel. Starting opposite the valve stem and using a tire iron, force the other tire bead over the rim flange and work progressively around the tire (fig. 127), holding the inserted portion of the bead in the well. Proceed until the tire bead is forced over the rim flange. Inflate the tire slowly. Deflate and reinflate to relieve the pressure of any folds or buckles and to allow the tube to assume its proper contour within the casing. Remove valve fishing tool.

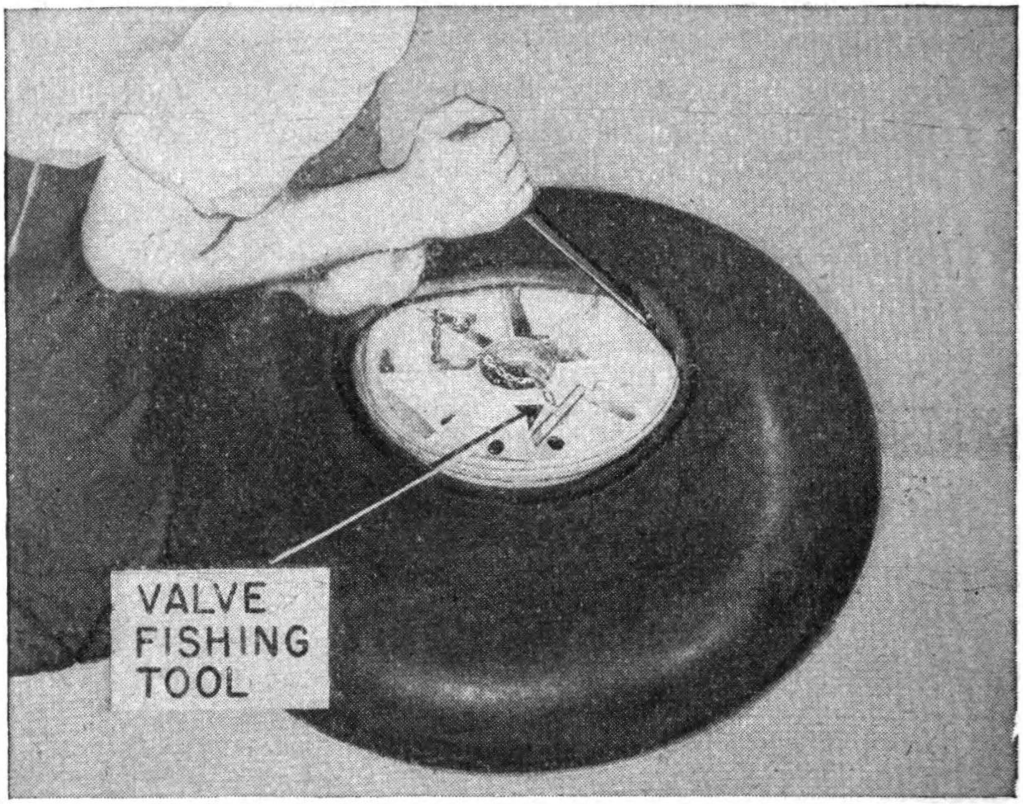


FIGURE 127.

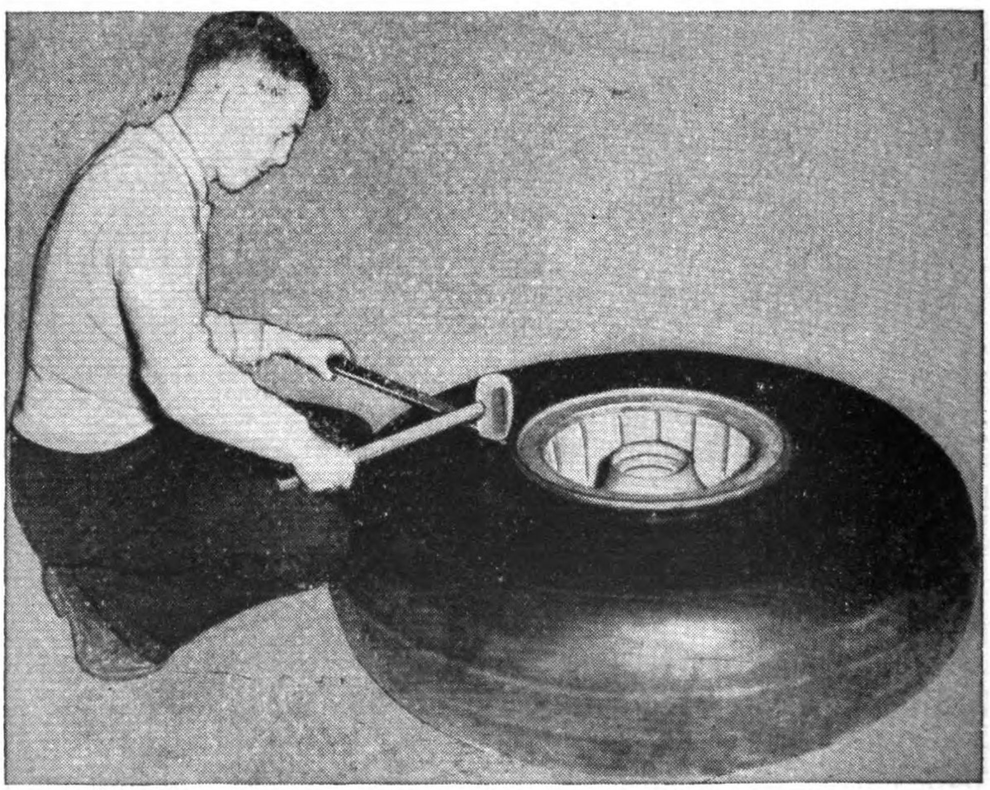


FIGURE 128.

71. Dismounting flat-base wheel with removable side flange and locking ring.—*a.* Deflate the tire fully by removing the valve core. Break both beads loose from the rim flange by forcing them, with a tire iron and rubber hammer, down towards the center of the rim (fig. 128).

b. After tire beads have been broken loose, pry one end of the locking ring loose, as shown in figure 129. Using a tire iron, work the locking ring loose progressively around the wheel, as shown in figure 130.

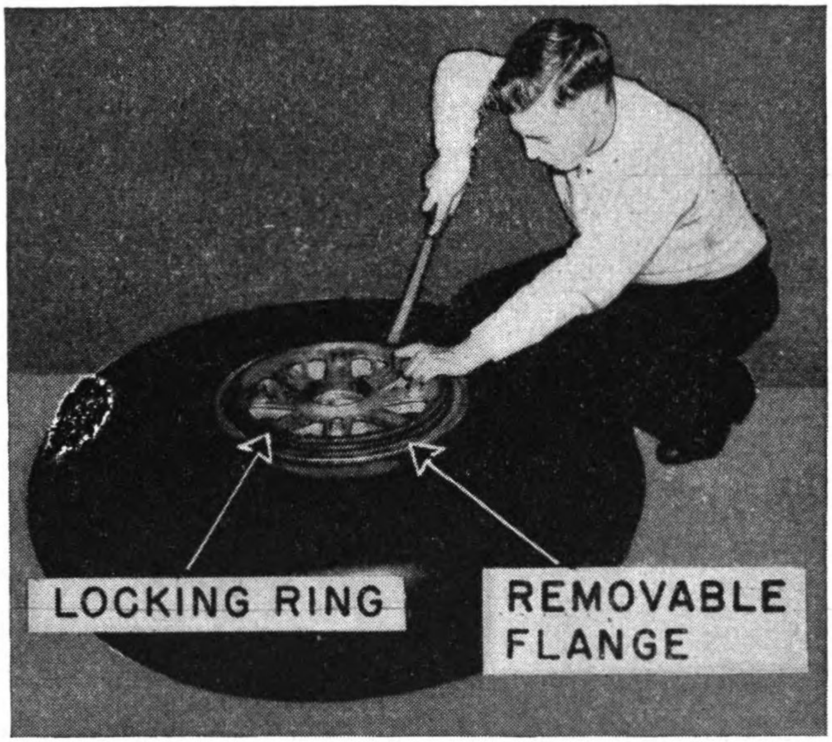


FIGURE 129.

c. When the locking ring has been removed, pull the removable side flange from the wheel (fig. 131). Push the valve through the valve hole of the wheel.

d. Turn tire over and remove wheel from tire (fig. 132).

72. Mounting flat-base wheel with removable side flange and locking ring.—*a.* Figure 133 shows the tire, tube, wheel, and necessary tools before assembly. Inspect the tire and tube as pointed out in paragraph 66*a* before mounting. The tube should be barely rounded with air and the tire and tube mounted for correct balance as explained in paragraph 54*c*.

b. Lay the wheel flat, removable flange side up, and place the tire on the wheel, guiding the valve through the valve hole in the wheel (fig. 134). Force both beads down on the rim as far as possible.

FIGURE 130.

FIGURE 131.

FIGURE 132.

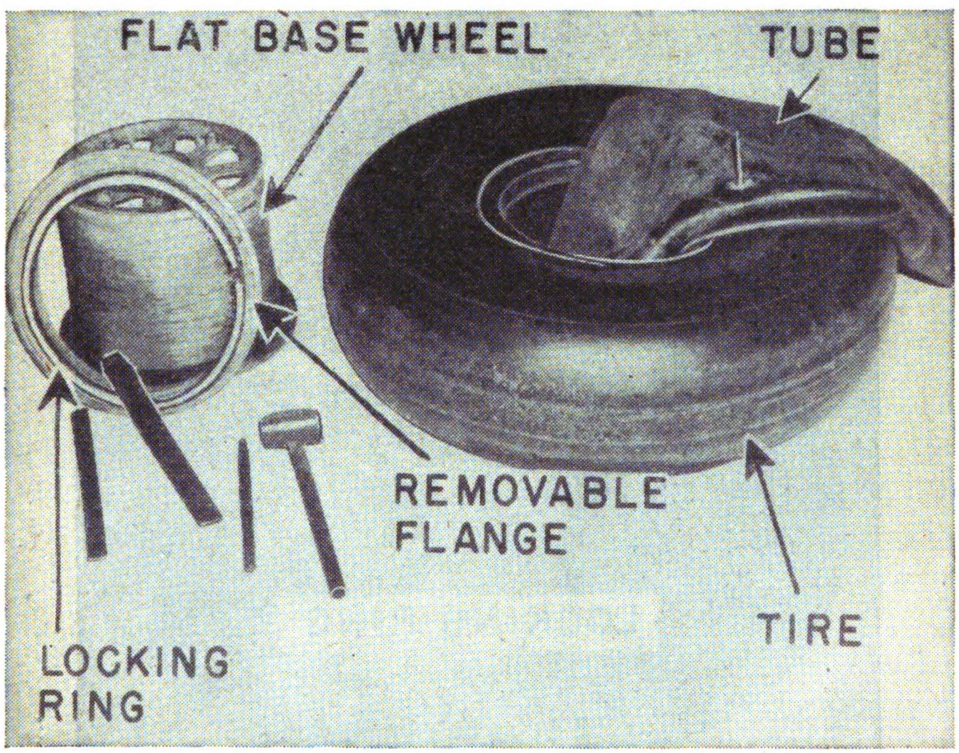


FIGURE 133.

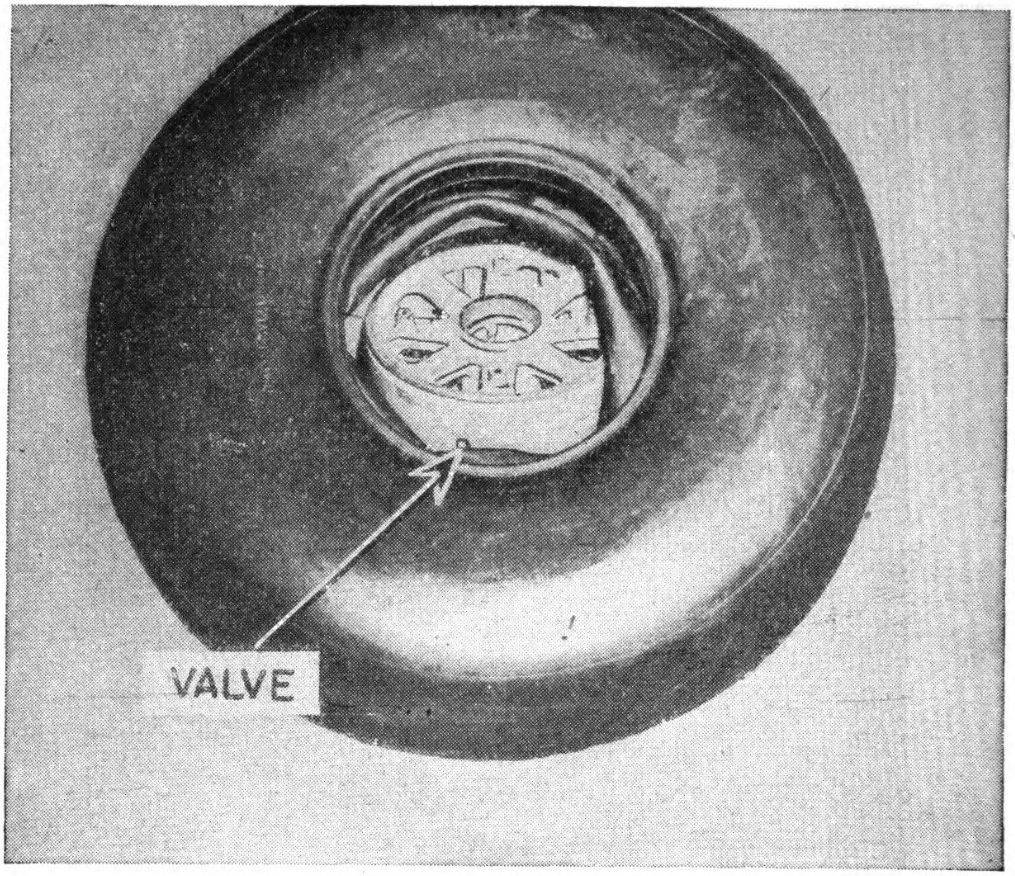


FIGURE 134.

FIGURE 135.

c. Place the removable flange on the wheel and force it down so that the locking ring can be installed.

d. Pry the locking ring on progressively by using a tire iron as shown in figure 135. Be sure that it is properly seated in the gutter of the rim before the air pressure is applied. A poorly adjusted ring can fly off and easily cause a fatal injury. So when applying pressure, *turn the assembly so that the locking ring is away from you.*

CHAPTER 4

VALVES, VALVE CAPS, GAGES, AND CHUCKS

73. General.—All pneumatic tubes are fitted with valves, through which they are inflated, and which hold the air pressure afterward. A valve consists of a stem which conducts air into the tube, a valve core which keeps air from escaping, and a valve cap which protects the core from dirt and water (fig. 136). Valve cores and caps are completely interchangeable, but stems are not.

74. Stems.—The stem is threaded inside and out, to accommodate the valve core and the valve cap. The valve (fig. 136) has a tapered seat on the inside against which the valve core seats. Stems on truck tires are generally bent to make them accessible and to protect them from flying stones (par. 76). Sometimes, as in figures 137 and 139, bridge washers are fastened to the stems to keep them straight if the tire slides on the rim. There are four principal kinds of stems, classified according to the way in which they are mounted on the tube:

a. The cured-on rubber-covered stem (fig. 136), used on passenger cars and light trucks, is vulcanized directly to the tube without any reinforcement. It is made in two types which look just alike—the hand-bendable and the nonbendable. Since a tool will damage a hand-bendable rubber-covered stem (par. 76), never try to bend any rubber-covered valve except by hand.

b. The all-metal cured-in stem (fig. 137) is permanently vulcanized to a reinforcement in the tube, and cannot be removed.

c. The spud-mounted stem (fig. 138) consists of two parts—a spud which is inserted through a reinforcement in the tube, and a stem which is screwed on the spud. The tube is compressed between the flange on the spud and the flange on the stem, making an airtight seal.

d. The clamp-in stem (fig. 139) used on motorcycles, is not vulcanized; it is merely clamped in a reinforced section of the tube. Bridge washers, which secure the stem, must be turned so they run with, and not across the tube.

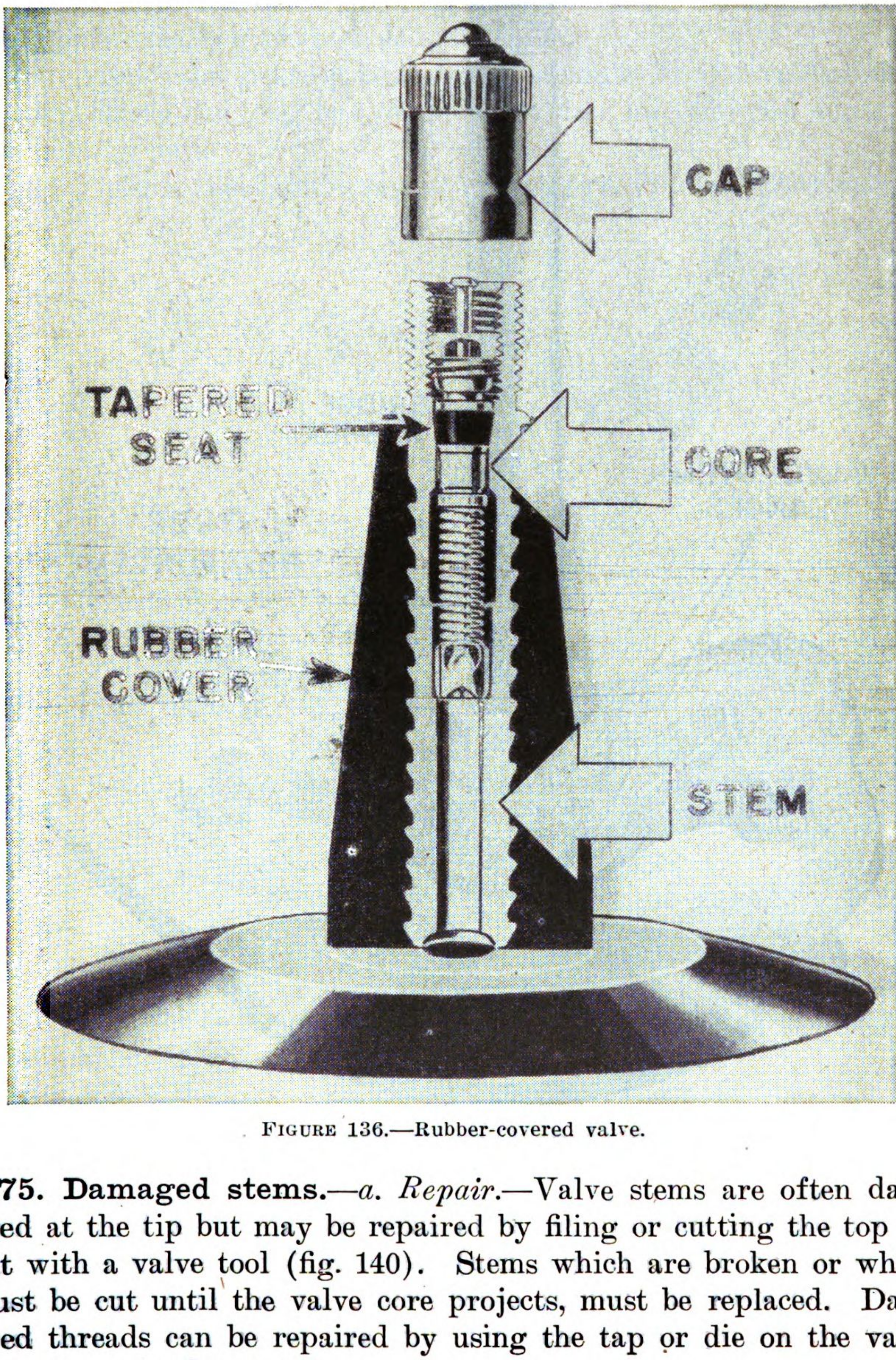


FIGURE 136.—Rubber-covered valve.

75. Damaged stems.—*a. Repair.*—Valve stems are often damaged at the tip but may be repaired by filing or cutting the top off flat with a valve tool (fig. 140). Stems which are broken or which must be cut until the valve core projects, must be replaced. Damaged threads can be repaired by using the tap or die on the valve tool shown in figure 146.

b. Replacement valve stems.—These are selected according to length and type. They are installed straight or with a single bend, and additional bends are made later as necessary. The Tire and Rim

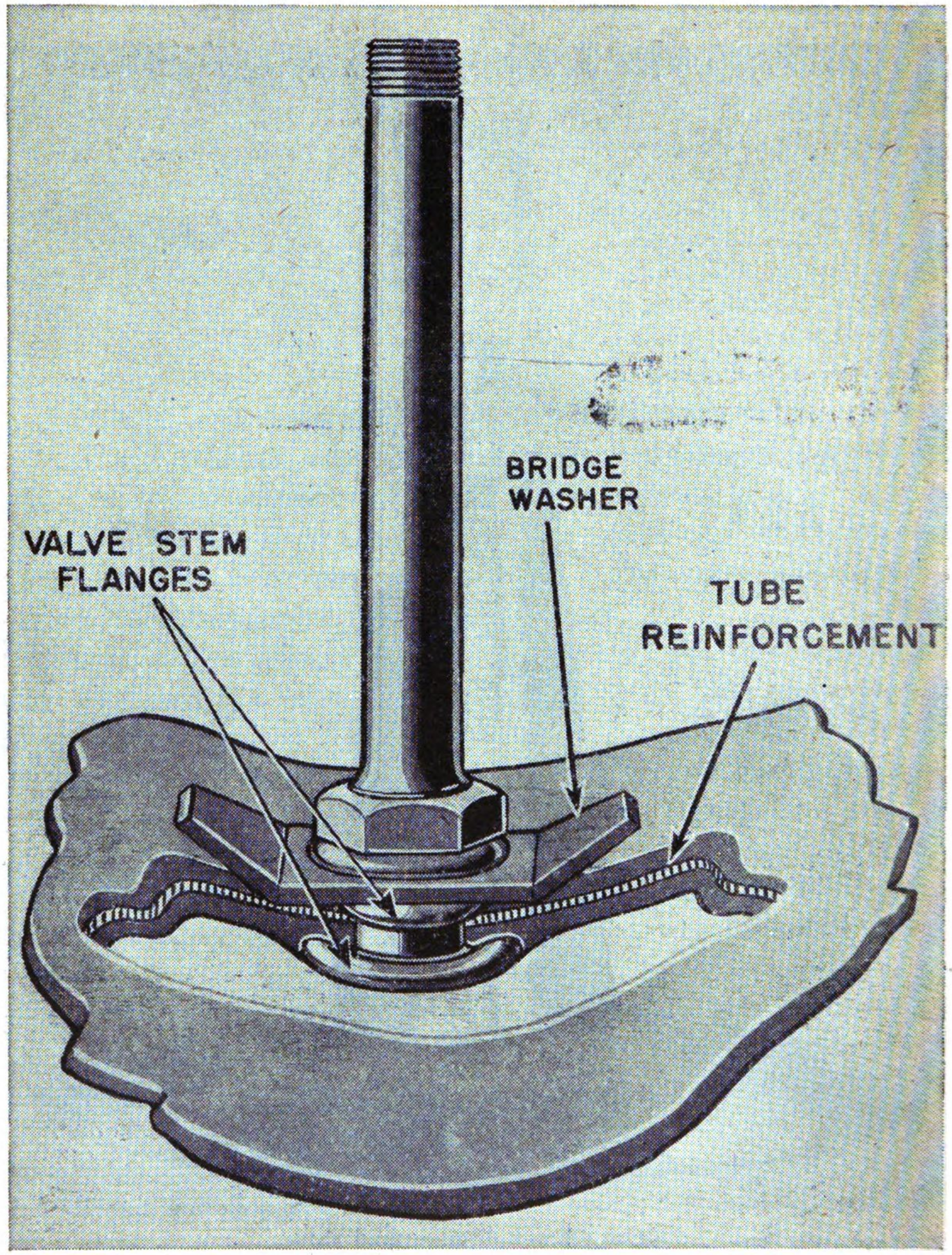


FIGURE 137.—All-metal cured-in valve.

Association has standardized stem sizes and appendix I gives suitable stems by TR (tire and rim) numbers for different size tires. Special purposes may require other stems. If the same type of stem failure occurs repeatedly, find out why, and select, install, and bend the stem (par. 76) so that the cause will be eliminated.

c. Rubber-covered valve stems.—These are replaced with the vulcanizer shown in figure 140, as follows:

(1) Cut off the broken valve stem as close to the tube as possible.

(2) Buff the tube down smooth.

(3) Remove the cloth covering from the replacement valve stem and apply exactly over the hole in the tube.

(4) Apply the heating unit, and assemble in the vulcanizer as shown, fitting the long feet of the vulcanizer into the two notches in the heating unit.

(5) Tighten the thumbscrew as much as possible with one hand.

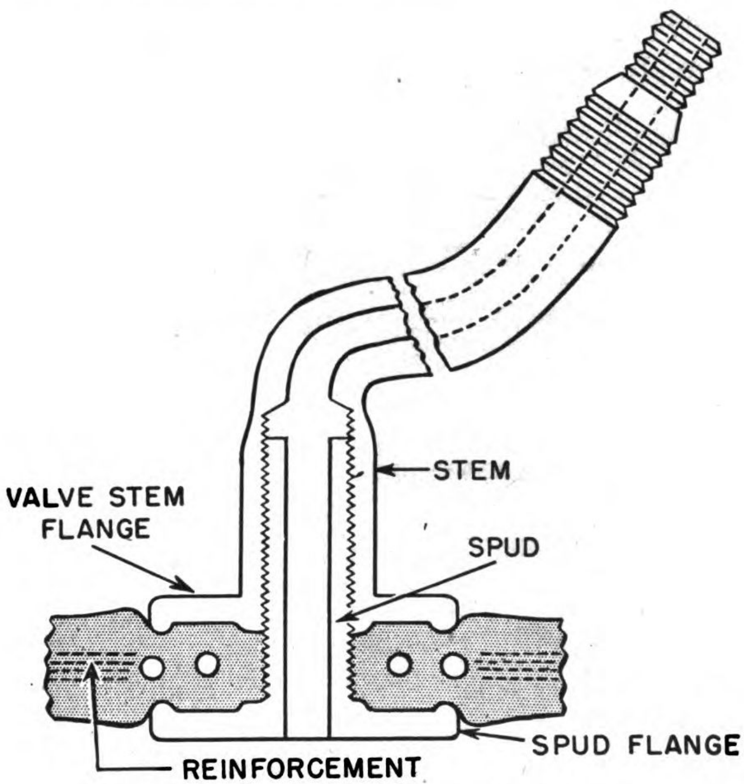


FIGURE 138.—Spud-mounted valve.

(6) Nick the heating material with a sharp tool and apply a lighted match at the nicks.

(7) When the heating unit is cool enough to hold your hand on (10 to 15 minutes later), loosen the thumbscrew and remove the tube.

d. All-metal cured-in valve stems (fig. 137).—These can be sawed off leaving a "spud," on which a replacement stem similar to a spud-mounted stem can be screwed. The hold-down tool (fig. 141) screwed on the valve holds the stem while it is cut off close.

e. Spud-mounted valve stems (fig. 138).—These are replaced by unscrewing and replacing the stems. Spuds can be replaced. To do

this, cut a small slit in the tube anywhere except directly opposite the valve. Push the spud into the tube and remove it through the slit. Push a new spud through the slit and into the reinforced hole. Moisten the tube around the spud and screw the stem on. Repair the slit with a hot patch as described in paragraph 16.

76. Bending valve stems.—The bending tool shown in figure 142 bends valve stems without crushing them. Except for hand-bendable stems, which will not be used frequently, all bends must be made in this tool. Any other method results in improper angles or crushed

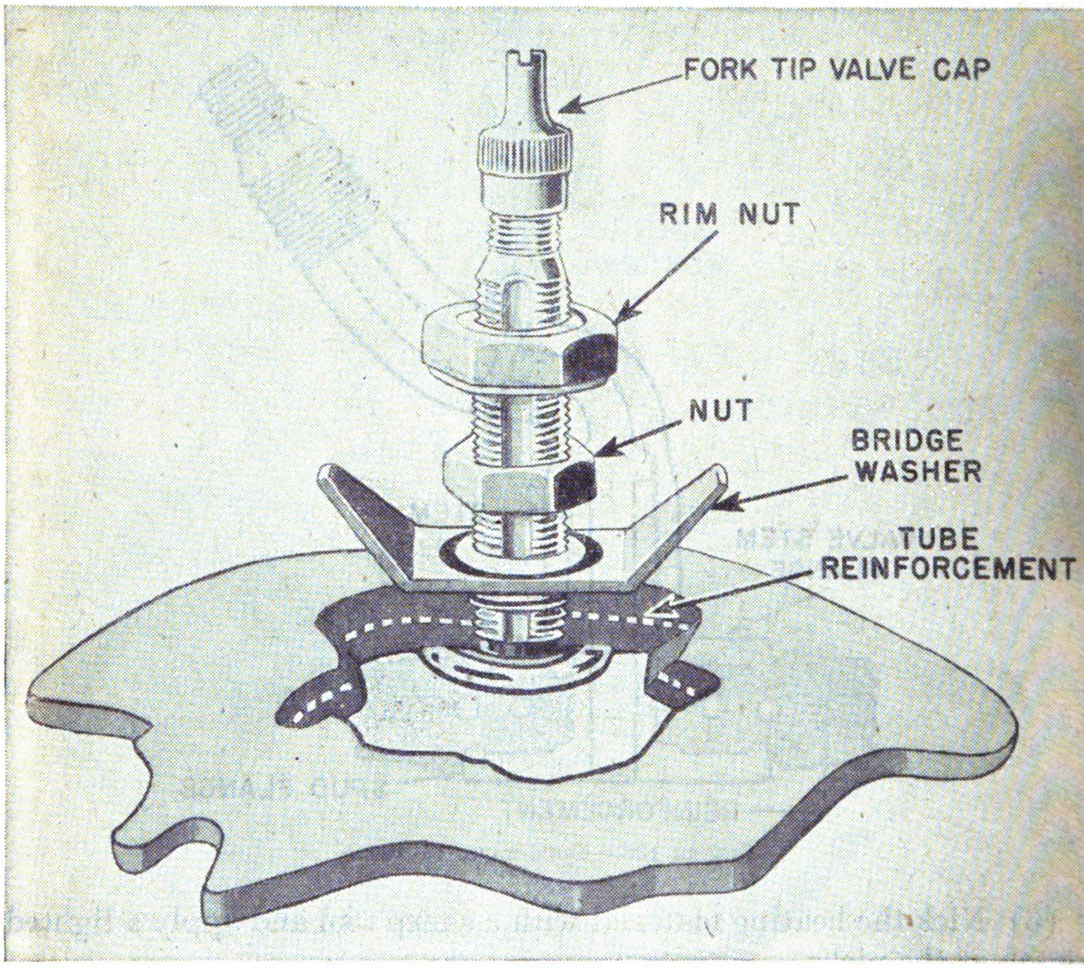


FIGURE 139.—Clamp-in valve.

stems. Stems that are threaded all the way cannot be bent. The first bend (fig. 143) is always made at an 86° angle and as close to the tube as the tool will permit. The first bend allows the valve stem to clear the brake drums. The second bend, if necessary, which prevents the stem sticking out beyond the tire, protects the tip from curbs, flying stones, etc., and makes it accessible to the air chuck when the wheel is on the vehicle. Keep this in mind when you make second

bends. The chart (fig. 143) furnishes information for various dimensions and bends.

a. The first bend is made as follows:

(1) Remove valve cap, bridge washer, and nut, if any, from valve.

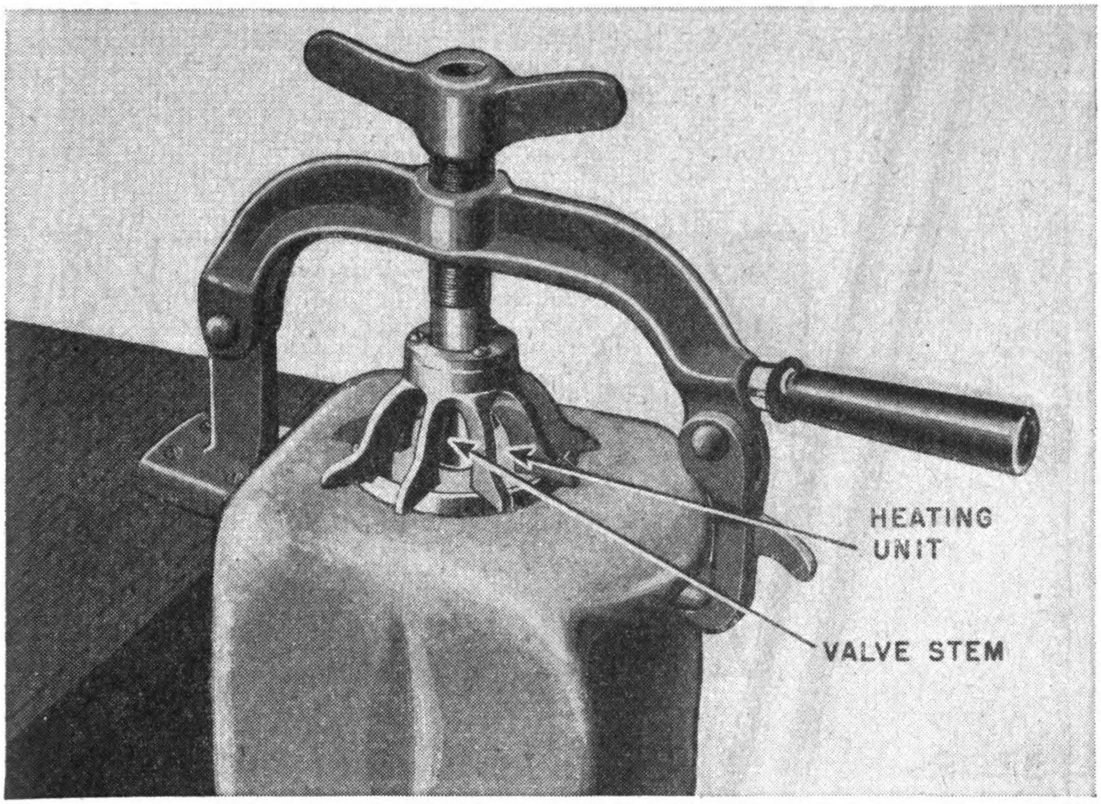


FIGURE 140.—Vulcanizer.

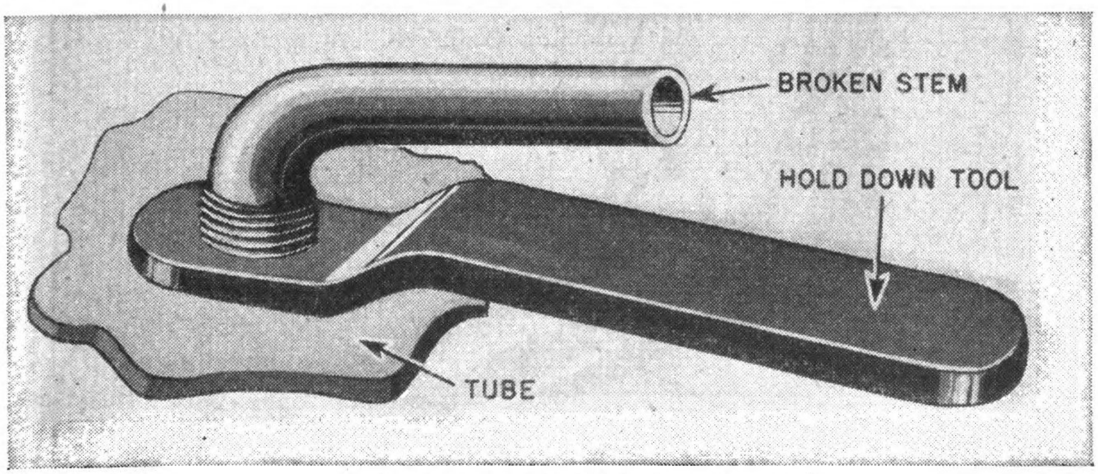


FIGURE 141.—Hold-down tool.

(2) Shift the sliding pin, at the back of bending block, away from the lettered scale.

(3) Insert the valve as far as possible into the hole in the bending block, from the front of the tool as shown in figure 142.

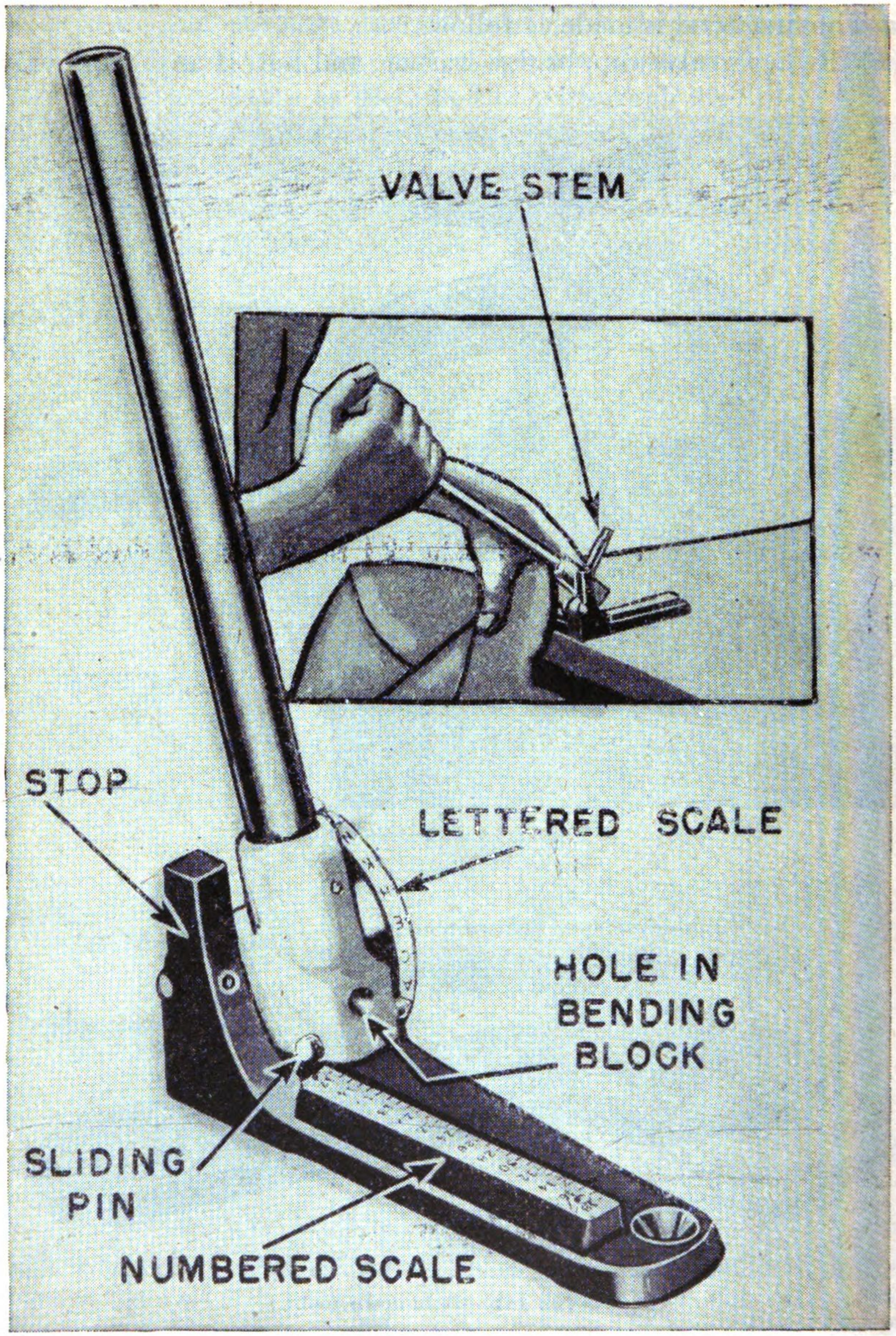
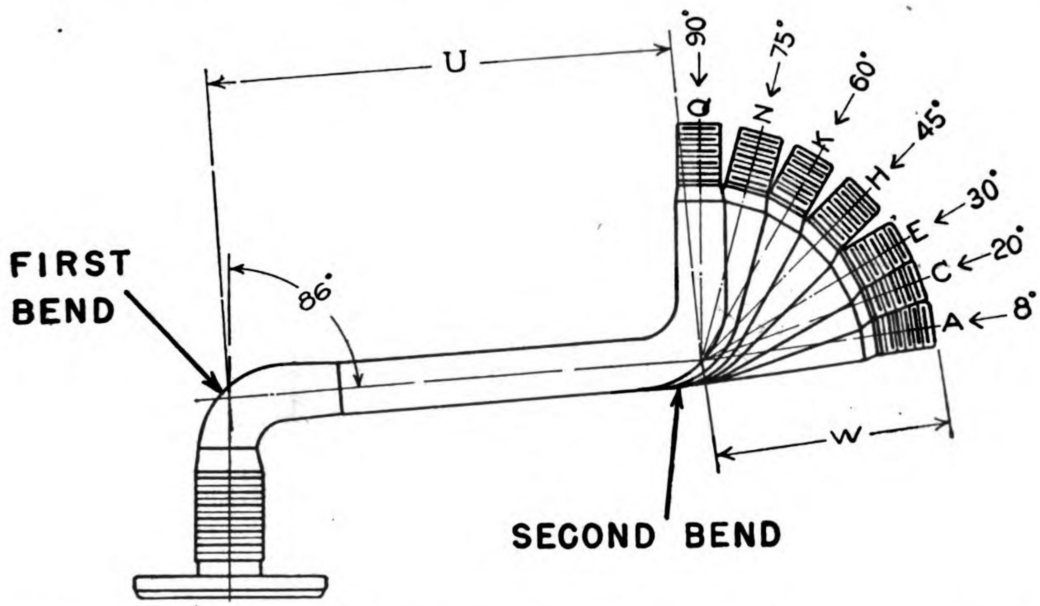


FIGURE 142.—Valve bending tool.

(4) Holding the valve securely so that it will bend in the proper direction, pull the handle down slowly until the sliding pin hits the stop. Be particularly careful that the stem does not turn.

(5) Slip the stem out of the tool.

b. The second bend is made like the first bend, except that the tip is inserted in the tool to the mark on the numbered scale, indicating the tip length "W" and dimension "U" on the chart (fig. 143). Move



TOOL SETTING		12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
WILL FURNISH TIP LENGTH "W" ALL VALVES		1½	1⅝	1¾	1⅞	2	2⅛	2¼	2⅜	2½	2⅝	2¾	2⅞	3	3⅛	3¼	3⅜	3½	3⅝	3¾	3⅞	4	4⅛	4¼	4⅜	4½
HORIZONTAL LENGTH "U"	TR 75 75A	1½	1⅜	1¼	1⅛																					
	TR 76 76A	1⅞	1¾	1⅝	1½	1⅜	1¼	1⅛																		
	TR 177 177A	2¼	2⅛	2	1⅞	1¾	1⅝	1½	1⅜	1¼	1⅛															
	TR 175 175A	3	2⅞	2¾	2⅝	2½	2⅜	2¼	2⅛	2	1⅞	1¾	1⅝	1½	1⅜	1¼	1⅛									
	TR 78 78A	3½	3⅜	3¼	3⅛	3	2⅞	2¾	2⅝	2½	2⅜	2¼	2⅛	2	1⅞	1¾	1⅝	1½	1⅜	1¼	1⅛					
	TR 179	4⅛	4	3⅞	3¾	3⅝	3½	3⅜	3¼	3⅛	3	2⅞	2¾	2⅝	2½	2⅜	2¼	2⅛	2	1⅞	1¾	1⅝	1½	1⅜	1¼	1⅛

NOTE — 1⅛" LENGTH "U" IS MINIMUM HORIZONTAL OBTAINABLE

FIGURE 143.—Valve bending chart.

the sliding pin toward the lettered scale, stop bending when the pin is opposite the letter designating the desired angle. The second bend must always allow at least a 1½-inch tip for the valve core.

77. Valve cores.—These are screwed into valve stems to prevent air from escaping. The construction of the core is shown in figure 144. The shell is provided with a rubber washer which seals against the tapered seat inside the stem, as in figure 136. The spring holds the solid cup with a rubber seat against the shell, closing the valve. Pushing the pin on which the spring and cup are mounted moves the

cup away from the shell and allows air to escape. Another type (fig. 145) has the spring concealed within the shell but it works the same way, and is interchangeable with that in figure 144. Flats are cut on the threaded portion so it may be screwed in and out with a forked-tip cap tool (fig. 147) or a valve tool (fig. 146).

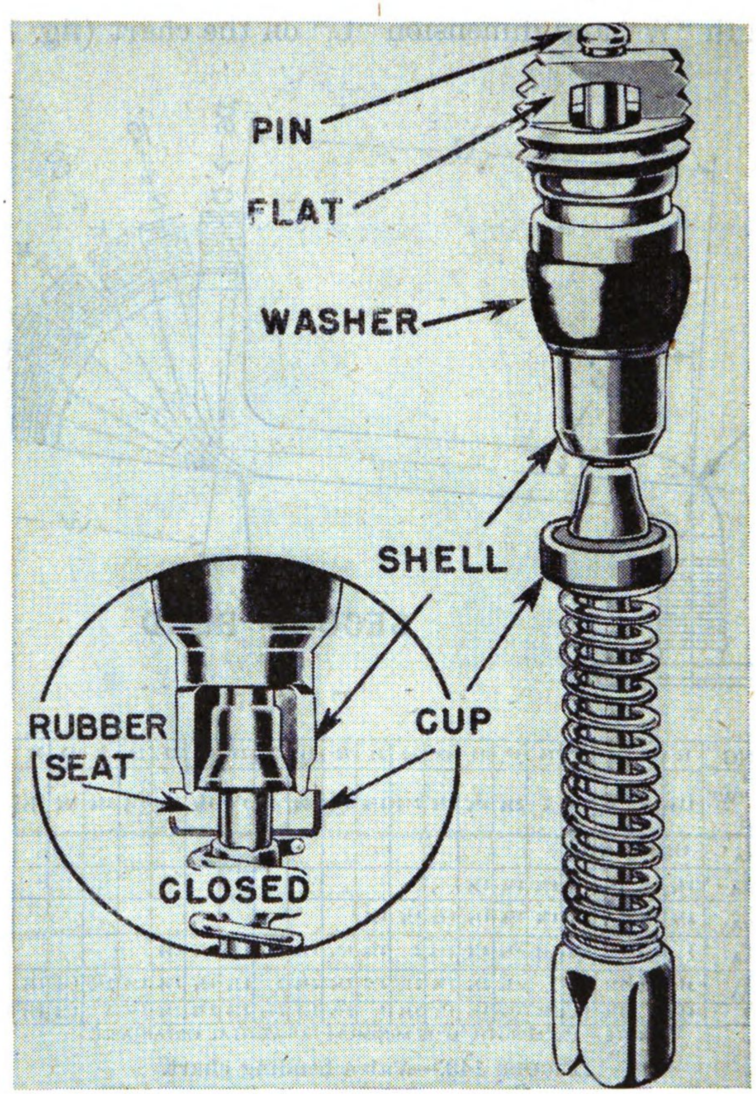


FIGURE 144.—Valve core, visible spring.

a. Heat-resisting valve cores.—In addition to the regular valve core explained above, there are also available valve cores equipped with heat-resisting rubber gaskets for use where intense heat is generated, especially where the valve stem is close to a large brake drum.

b. Installation.—A valve core should be installed only tight enough to seal the rubber washer against the tapered seat (fig. 136). You may easily break it if you twist it with more than the force of two fingers. Very small pieces of dirt can prevent it from sealing. If it

still leaks after moderate tightening, remove, clean, and inspect it. Further tightening will break off the flats and make it almost impossible to remove the core, but the leak will persist.

c. Leaks.—(1) Both the rubber seat and the washer (fig. 144) harden or wear out, causing leaks. To detect a leaking valve, wet your finger and rub a film of moisture across the tip of the stem.

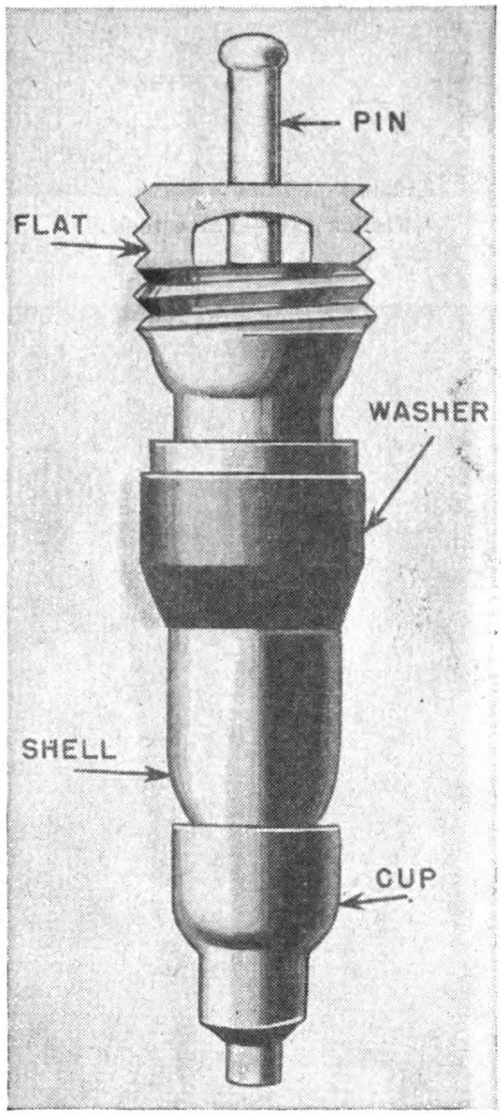


FIGURE 145.—Valve core, concealed spring.

If there are any leaks, bubbles will appear. Remove the leaking valve core and inspect the seat and washer. If it has any dirt, cuts, or rings, replace it.

(2) If the leak continues, clean the stem. First clean the inside threads with the tap on the valve tool (fig. 146) and then pump the tube up without the valve core and let it deflate. Never try to clean the stem with a wire or a wooden splinter, because you may scratch

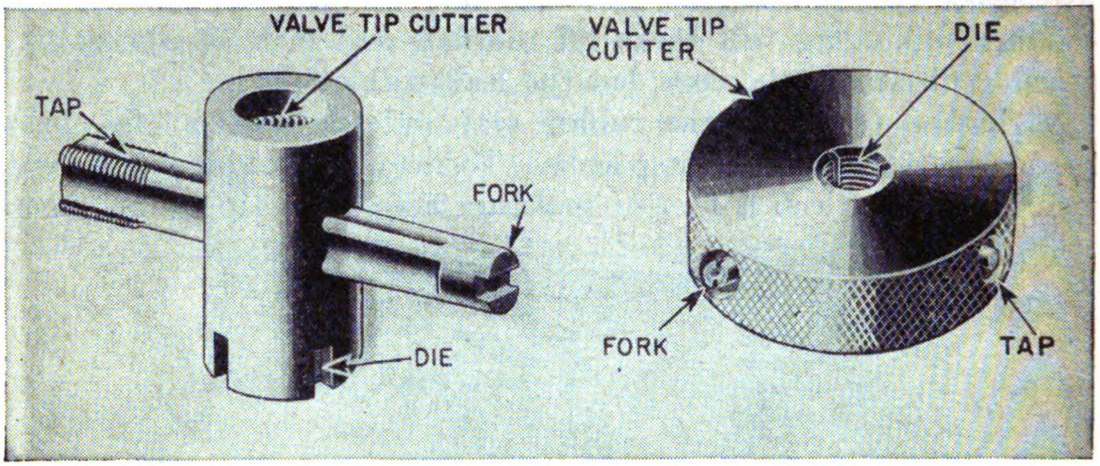
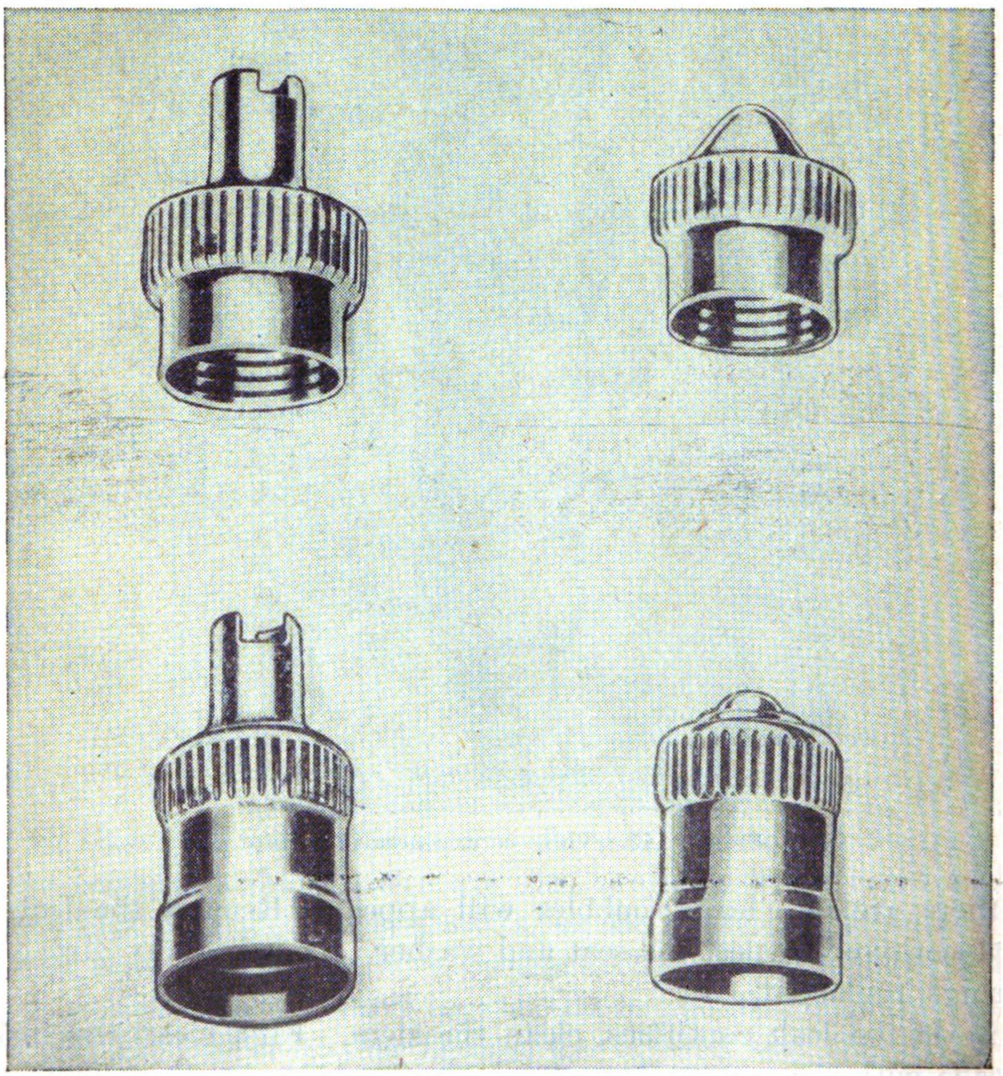


FIGURE 146.—Valve tools.



① Fork tip. ② Dome tip.

FIGURE 147.—Valve caps.

the tapered seat (fig. 136) or clog the stem with a piece of the wood. If the rush of air does not clean the stem, replace it.

d. Valve tool (fig. 146).—These tools are essential in working with valves. The forked end removes and replaces cores, the tap cleans the inside threads, the die cleans the outside threads, and the cutter smooths burred valve tips.

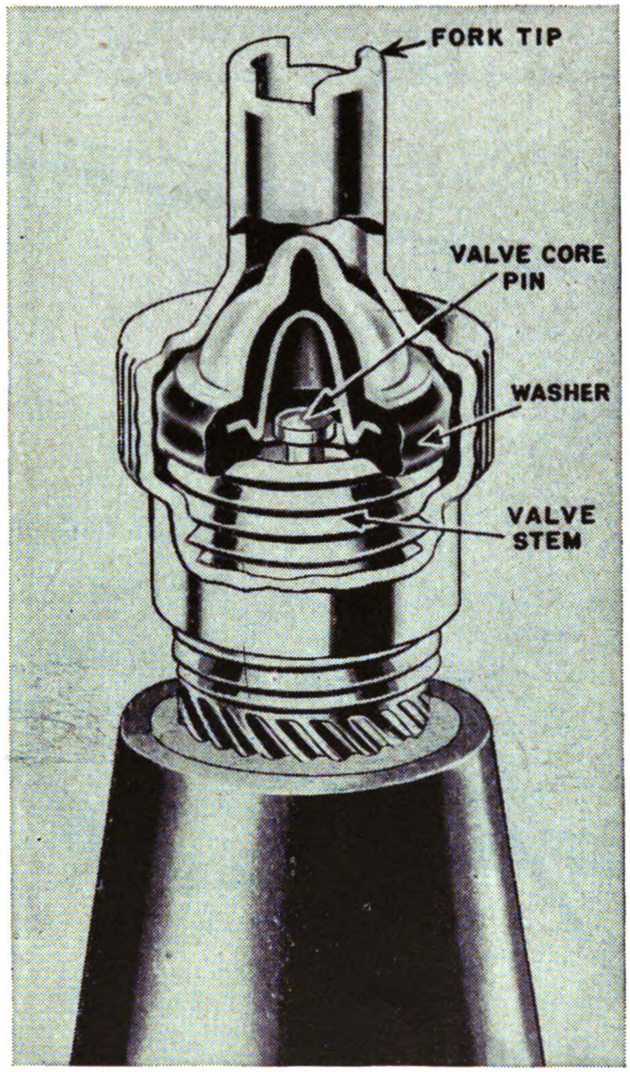


FIGURE 148.—Cutaway view of valve cap on stem.

78. Valve caps (fig. 147).—These caps are to keep the core clean and act as an extra seal. When they are lost they must be replaced. All valve caps have rubber washers which seal against the tip of the stem as shown in figure 148.

a. Each washer has a hole or indentation in the center to keep it from depressing the pin in the core. Caps with good washers are airtight. They will assist in preventing loss of air, but they cannot be depended upon to stop leaks permanently. One of the four styles

shown in figure 147 will be used for all replacements except on special instruction. Those with forked ends may be used to remove and replace valve cores.

b. The seal formed in the cap is between the valve tip and the washer, and any cap that does not flare enough or is so long that

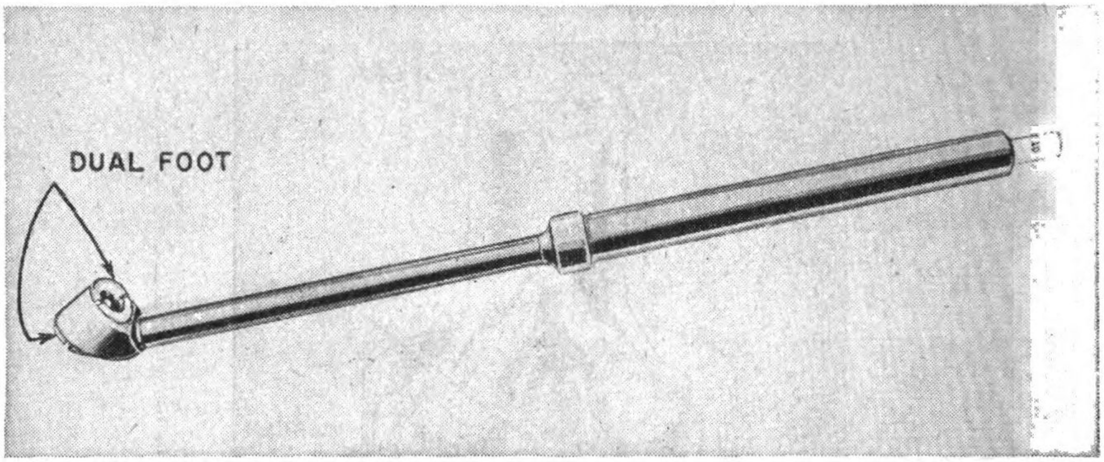


FIGURE 149.—Dual-foot hand gage.

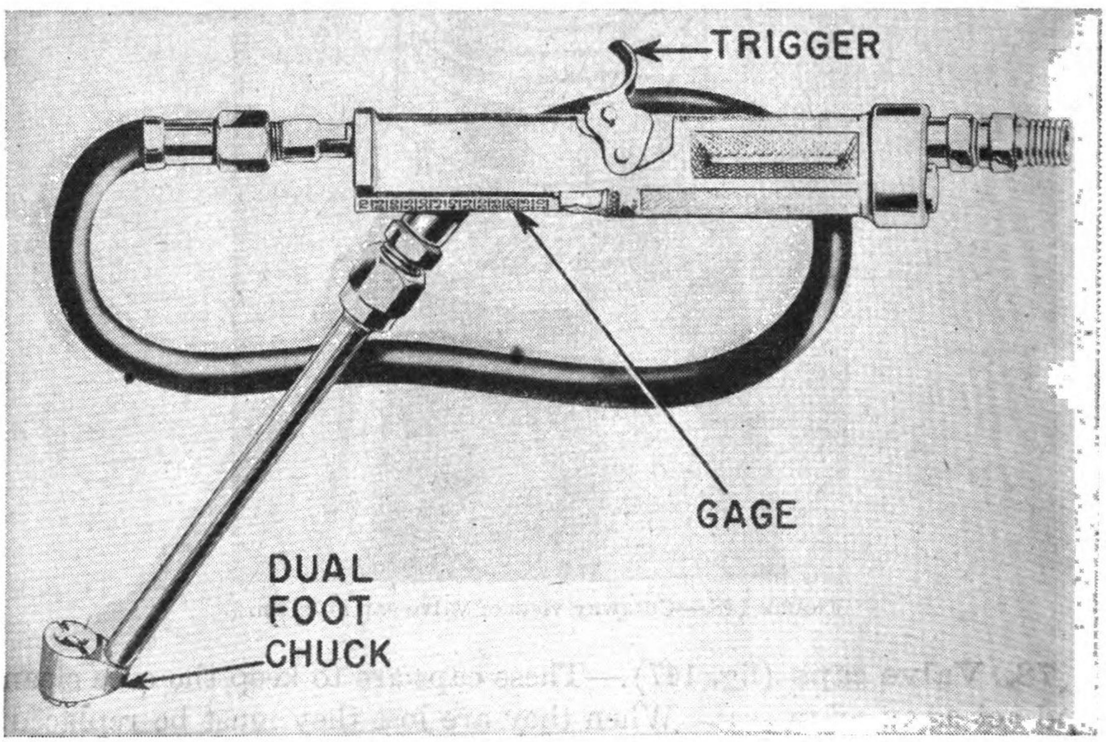


FIGURE 150.—Air hose gage with dual-foot chuck.

it touches the shoulder on the stem before the washer touches the tip, should be changed. Any caps with worn washers or without washers should be replaced.

79. Gages (figs. 149 and 150).—These gages are used to check tire pressure.

a. Gages are made in many shapes and sizes so that they may be applied to stems in different positions. They may also be combined with the chuck on the air line from the air compressor (par. 80). A dual-foot gage (fig. 150) is generally recommended as it can be used on almost any tire.

b. Air gages become inaccurate through use and should be checked at least once a month. A new gage, which would be known as a master gage, should be laid aside and used only for testing the gages used every day. Check them at various pressures because a gage

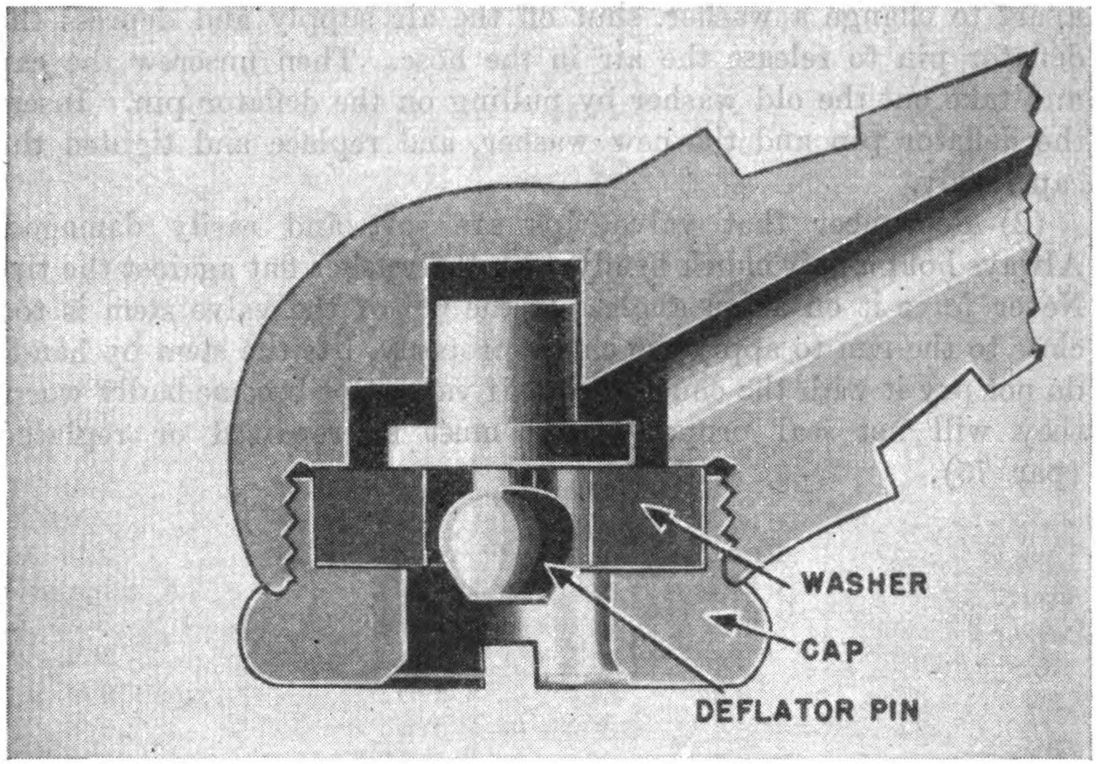


FIGURE 151.—Air chuck.

that is accurate at 35 pounds pressure may be far off at 75 pounds. A gage that reads inaccurately can be used as long as it is consistently inaccurate. If you know how far it consistently reads from normal, you can add or subtract enough to compute the actual pressure.

80. Chucks (fig. 151).—These are devices attached to the end of an air-supply hose or a gage to allow air to flow from the air line to the tire, or from the tire to the gage. When the air line is not in use, the air pressure holds the deflator pin against the washer (fig. 151). Applying the chuck to the valve tip raises the deflator and allows air to blow into the tire. The tire valve tip, sealing against the washer in the chuck, prevents loss of air.

a. Combination chuck and gage (fig. 150).—When inflating a tire with a combination chuck and gage, apply the chuck to the valve and pull the trigger. To check air pressure, release the trigger and keep the chuck pressed against the valve. Some gages and chuck combinations have a second valve which releases the air from the tire tube if it is overinflated.

b. Replacing washers.—(1) If any air escapes when you hold the chuck firmly against the tip without tilting, a new washer (fig. 151), is probably needed. Worn washers waste air pressure, and greatly lengthen the time required to inflate the tire. Before taking a chuck apart to change a washer, shut off the air supply and depress the deflator pin to release the air in the hose. Then unscrew the cap and take out the old washer by pulling on the deflator pin. Insert the deflator pin and the new washer, and replace and tighten the cap firmly.

(2) Remember that valve tips are soft and easily damaged. Always hold an air chuck firmly with the washer flat against the tip. Never force it on at an angle. If the tip of the valve stem is too close to the rim to apply the chuck properly, lift the stem by hand; do not pry it with the chuck. And if valve tips become badly worn, they will not seal properly, and must be repaired or replaced (par. 75).

APPENDIX I

TABLES

TABLE I.—*Tire and rim data*

Tire size	Air pressure	Valve stem	Rim size	Rim type	Width (inches)	Dual spacing[1]
4.00-12/4	30	TR13	12 x 2.50	DC	2½	--------
4.00-19/4	30	TR11	19 x 2.50	DC	2½	--------
4.00-18/4	30	TR11	18 x 2.50	DC	2½	--------
4.50-18/4	30	TR11	18 x 2.75	DC	2¾	--------
5.50-16/4	30	TR15	16 x 3.50	DC	3½	--------
6.00-16/4[2]	30	TR15	16 x 4.00	DC	4	--------
6.00-16/6[2]	30	TR15	16 x 4.00	DC	4	--------
6.50-16/4[2]	30	TR15	16 x 4.50	DC-SDC	4½	--------
6.50-16/6[2]	30	TR15	16 x 4.50	DC-SDC	4½	--------
7.00-16/4	30	TR15	16 x 5.00	DC-SDC	5	--------
7.00-16/6	30	TR15	16 x 5.00	DC-SDC	5	--------
7.00-15/4	30	TR15	15 x 5.00	DC-SDC	5	--------
7.00-15/6	30	TR15	15 x 5.00	DC-SDC	5	--------
7.50-16/4	40	TR15	16 x 5.50	DC-SDC	5½	--------
7.50-16/6	40	TR150	16 x 5.50	DC-SDC	5½	--------
Light truck "15"/6	40	TR177A	15 x 5.50	DC-SDC	5½	--------
9.00-16/8	40	TR177A	16 x 6.50	CS	6½	(11½)[3]
6.00-20/6	50	TR75	20 x 3.75	FB	3¾	7¾
6.50-20/6	50	TR75	20 x 3.75	FB	3¾	8¼
7.00-20/8	55	TR76	20 x 4.33	FB	4²¹⁄₆₄	9
7.50-20/8	55	TR177A	20 x 5.00	FB	5	10
8.25-20/10	60	TR177A	20 x 5.00	FB	5	10½
9.00-20/10	65	TR175A	20 x 6.00	FB	6	11½
10.00-20/12	70	TR175A	20 x 7.33	FB	7²¹⁄₆₄	12¾
10.00-22/12	70	TR175A	20 x 7.33	FB	7²¹⁄₆₄	12¾
11.00-20/12	70	TR78A	20 x 7.33	FB	7⁷¹⁄₆₄	12¾
11.00-22/12	70	TR78A	22 x 7.33	FB	7²¹⁄₆₄	12¾
12.00-20/14	80	TR78A	20 x 8.37	FB	8⅜	13¼
12.00-24/14	80	TR78A	24 x 8.37	FB	8⅜	13¼
14.00-20/16	90	TR179	20 x 10.00	FB	10	(16½)[3]

[1] This is the minimum dual spacing allowed; however, on quartermaster vehicles the spacing is greater to permit the use of chains and other traction devices.
[2] Use 16 x 4.50 CS rims with combat tires.
[3] Generally not used as duals.

DC—drop center.
SDC—semidrop center.
CS—combat ("S" flange).
FB—flat base.

TABLE II.—*Ordnance gun carriages*

Name	Model	Weight per wheel [1]	Type rim	Wheel size	Tire size	No. ply	Inflation [2] Minimum	Inflation [2] Maximum	Wheels per unit
37-mm gun carriage	M3	1, 341	FB	18 x 5	5. 50–18	6	38	40	4
37-mm AA gun carriage	M3A1	1, 341	FB	18 x 5	5. 50–18	6	38	40	4
37-mm gun carriage	M4	456	DC	16 x 4. 00E	6. 00–16	6	20	36	2
40-mm AA gun carriage	M1	1, 362	FB	20 x 5	6. 00–20	6	50	50	4
57-mm gun carriage	M1	1, 175	SDB	16 x 5. 50F	7. 50–16	8	25	44	2
75-mm gun carriage	M1897A4	1, 504	FB	24 x 6	7. 50–24	8	40	55	2
75-mm gun carriage	M2A1	1, 724	FB	24 x 6	7. 50–24	8	40	55	2
75-mm gun carriage	M2A2	1, 724	FB	24 x 6	7. 50–24	8	40	55	2
75-mm gun carriage	M2A3	1, 700	FB	24 x 6	7. 50–24	8	40	55	2
75-mm gun carriage	M1916A1	1, 605	FB	24 x 6	7. 50–24	8	40	55	2
75-mm gun carriage	M1916M1A1	1, 605	FB	24 x 6	7. 50–24	8	40	55	2
75-mm gun carriage	M1917A1	1, 495	FB	24 x 6	7. 50–24	8	40	55	2
75-mm howitzer	M2A1	975	FB	20 x 5	6. 00–20	6	40	50	2
75-mm howitzer	M3	1, 012	FB	20 x 5	6. 00–20	6	40	50	2
75-mm howitzer carriage	M3A1	1, 045	FB	20 x 5	6. 00–20	6	40	50	2
105-mm howitzer carriage	M1A1	1, 982	FB	24 x 6	7. 50–24	8	40	55	2
105-mm howitzer carriage	M2	2, 118	FB	24 x 6	7. 50–24	8	45	55	2
8-inch howitzer carriage	M1	3, 055	FB	20 x 9–10	11. 00–20	12	50	70	10
155-mm gun carriage	M1	2, 990	FB	20 x 9–10	11. 00–20	12	50	70	10
155-mm gun carriage (GPF)	M2 and M3	8, 500	FB	24 x 11	14. 00–24	16	80	90	2
	(Limber M3)	4, 000	FB	20 x 9–10	11. 00–20	12	60	70	2
3-inch AA gun carriage	M1A1	4, 200	FB	22 x 9–10	10. 00–22	12	70	70	4
3-inch AA gun carriage	M2A1 No. 1–6	4, 200	FB	22 x 9–10	10. 00–22	12	70	70	4
3-inch gun carriage	M2A1 No. 7 and up	4, 200	FB	22 x 9–10	10. 00–22	12	70	70	4

3-inch AA gun carriage	M2A2	4, 200	FB	22 x 8	10. 00–22	12	70	70	4
90-mm AA gun carriage	M1	4, 400	FB	22 x 8	10. 00–22	12	70	75	4
4.5-inch gun carriage	M1	6, 000	FB	20 x 11	14. 00–20	16	60	90	2
155 mm howitzer carriage	M1917A3	4, 759	FB	24 x 11	13. 00–24	16	50	85	2
155-mm howitzer carriage (new)	M1917A4	4, 500	FB	24 x 11	13. 00–24	16	50	85	2
155-mm howitzer carriage	M1918A1	4, 759	FB	24 x 11	13. 00–24	16	50	85	2
155-mm howitzer carriage (new)	M1918A3	4, 500	FB	24 x 11	13. 00–24	16	50	85	2
155-mm howitzer carriage (new)	M1	6, 000	FB	20 x 11	14. 00–20	16	60	90	2
Caisson, light	M1	1, 000	FB	20 x 5	6. 00–20	6	40	50	2
Limber, light	M2	700	FB	20 x 5	6. 00–20	6	30	50	2

[1] Weight includes gun and carriage.
[2] Maximum inflations are to be used when traveling at high speeds on smooth roads; under other conditions use minimum inflation.
DC—drop center.
SDB—semidrop base.
FB—flat base.

TABLE III.—*Other ordnance vehicles*

Vehicle	Model	Gross weight	Tire size	Number ply	Inflation	Number wheels per unit	Type rim	Wheel size
Heavy wrecking truck	M1	36,000	11.00–20	12	70	10	FB	20 x 9–10.
Bomb trailer	M5	7,000	Rr. 7.50–18	6	55	2	FB	18 x 7.
			Fr. 6.50–10 (Jumbo jr.)		35	2	DC (split wheel)	5.00F.
Bomb service truck	M1 Diamond T	7,105	7.50–16	8	45	4	DC	16 x 5.50F.
	GMC	7,105	7.50–16	8	45	4	DC	16 x 5.50F.
	Ford	7,105	7.50–17	8	45	4	FB	17 x 7.
Bomb lift truck	M1	2,300	5.00–4	6	55	3	(Std. comm. airplane type)	4 x 3½ tail wheel.
Half-track car	M2	17,500	8.25–20	10	60	2	FB	20 x 7.
Half-track personnel carrier	M3	17,500	8.25–20	10	60	2	FB	20 x 7.
Half-track mortar carrier	M4	17,500	8.25–20	10	60	2	FB	20 x 7.
Welding truck	M1, M2, M3 Marmon.	13,000	7.50–20	8	55	6	FB	20 x 7.
Emergency repair truck	M1 Herrington	5,600	7.50–15	6	40	4	SDB	15 x 5.50F.
	Dodge	7,140	7.50–16	6	40	4	FB	20 x 7.
Scout car	M1	8,860	8.25–20	10	45	4	FB	20 x 7.
Do	M2	9,160	8.25–20	10	45	4	FB	20 x 7.
Do	M4	9,565	8.25–20	10	50	4	FB	20 x 7.
Do	M3A1	11,660	8.25–20	10	40 front, 65 rear	4	FB	20 x 7.
Mortar motor carriage	M2	9,660	8.25–20	10	50	4	FB	20 x 7.

Instrument repair truck	M1	13, 000	7. 50–20	8	55	6	FB	20 x 7.
Small arms repair truck	M1	13, 000	7. 50–20	8	55	6	FB	20 x 7.
Tank maintenance truck	M1	13, 000	7. 50–20	8	55	6	FB	20 x 7.
Artillery repair truck	M1, M2	13, 000	7. 50–20	8	55	6	FB	20 x 7.
Automotive repair truck	M1, M2	13, 000	7. 50–20	8	55	6	FB	20 x 7.
Machine shop truck	M2, M3, M4	13, 000	7. 50–20	8	55	6	FB	20 x 7.
Tool and bench truck	M2	13, 000	7. 50–20	8	55	6	FB	20 x 7.
Emergency repair truck	M2	5, 740	7. 50–16	6	40	4	SDB	16 x 5.50F.
Light repair truck	T1	5, 740	7. 50–16	6	40	4	SDB	16 x 5.50F.

D. C.—drop center.
S. D. B.—semidrop base.
F. B.—flat base.

TABLE IV.—*Smooth contour—airplane casings*

Casings	Size	Ply	Static test load (pounds)	Test inflation pressure (pounds per square inch)	Static unbalance (ounces) maximum
Landing wheel, nonskid tread	27	8	3, 300	39	12
	30	8	4, 500	45	17
	33	8	6, 500	54	22
	36	10	8, 500	53	32
	39	10	10, 000	55	37
	44	10	12, 000	54	50
	47	12	15, 000	62	57
	51	14	19, 000	61	70
	56	16	30, 000	81	87
	65	16	37, 500	81	125
Auxiliary wheel, smooth tread	8. 00	4	400	45	----------
	10. 00	6	700	45	----------
	12. 50	6	1, 100	45	----------
	14. 50	6	1, 500	45	----------
	17. 50	6	2, 100	50	----------
	19. 00	6	2, 600	50	10
	23. 00	8	4, 800	65	12
	26. 00	8	5, 500	55	17
	30. 00	8	6, 500	50	19

TABLE V.—*High pressure—airplane casings*

Casings	Size	Ply	Static test load (pounds)	Test (A) inflation pressure (pounds per square inch)	Static unbalance (ounces) maximum
Landing wheel	26 x 6–14	8	4, 000	95	17
	30 x 7–16	8	5, 000	90	19
	32 x 8–16	8	6, 000	90	21
	34 x 9–16	10	7, 000	80	27
	38 x 10–18	10	8, 000	80	35
	30 x 5–20 [1]	4	1, 600	50	19
	32 x 6–20 [1]	4	2, 200	55	21
	36 x 8–20 [1]	6	4, 000	60	30
	40 x 10–20 [1]	6	5, 500	65	40
Auxiliary wheel	10 x 3–4 [1]	4	400	55	----------

[1] Inactive for new design, and rayon or cotton construction optional.

TABLE VI.—*Low pressure—airplane casings*

Casings	Size	Ply	Static test load (pounds)	Test inflation pressure (pounds per square inch)	Static unbalance (ounces) maximum
Landing wheel	27.50 x 8.90–12.50 [1]	4	1,600	18	17
	20 x 7.00–6	4	1,200	24	17
	22 x 6.50–10	6	1,700	31	17
	24 x 7.50–10	6	2,100	32	17
	26 x 8.50–10	6	2,800	35	17
	39 x 13.50–16	10	9,000	50	45
	42 x 15.00–16	10	12,000	49	45
	44 x 16.00–16	10	13,500	50	50
	45 x 17.00–16	10	15,000	53	52
	45 x 20.00–18 [2]	12	18,000	62	52
	55 x 19.00–23	16	26,500	73	82
Auxiliary wheel	13 x 5.00–4	4	800	35	----------
	17 x 7.00–5	4	1,600	40	----------
	19 x 8.00–5	6	2,700	50	----------
	22 x 9.00–6	8	4,000	50	17
	24 x 10.00–7	10	6,000	65	17

[1] Oversize casing for 24-inch streamline wheel.

[2] This casing requires an all-rubber inner liner; ¼-inch minimum tread thickness; extend from shoulder to shoulder of casing; tapered at both edges; typical inner liner compression fit; maximum weight 15 pounds.

TABLE VII.—*Extra low pressure—airplane tires*

Casings	Size	Ply	Static test load (pounds)	Test inflation pressure (pounds per square inch)	Static unbalance (ounces) maximum
Landing wheel	29 x 13–5 [1]	6	3,400	20	20
	30 x 13–6	6	4,625	28	20
	35 x 15–6	6	5,600	25	28
	45 x 20–10	10	13,500	38	52
Auxiliary wheel	12 x 5–3	4	1,200	60	----------
	16 x 7–3	4	1,950	50	----------
	18 x 8–3	4	2,250	50	----------

[1] Inactive for new design, and rayon or cotton construction optional.

TABLE VIII.—*Streamline—airplane casings*

Casings	Size	Ply	Static test, load (pounds)	Test inflation pressure (pounds per square inch)	Static unbalance (ounces) maximum
Landing wheel [1]	24	4	1, 600	26	12
	27	6	2, 200	28	17
	31	6	3, 100	32	19
	36	6	4, 500	34	32
	40	8	6, 000	38	39
	45	8	8, 100	42	57
	50	8	10, 500	42	70

[1] All sizes inactive for new design, and rayon or cotton construction optional.

NOTE.—Smooth contour auxiliary wheel casings will be substituted for streamline tail wheel casings as follows:

Smooth contour (size)	*Streamline (size)*
8. 00	8. 00
10. 00	10. 50
12. 50	13. 25
14. 50	15. 50
17. 00	18. 00
19. 00	20. 00

APPENDIX II

GLOSSARY

Boot.—A patch made of rubber and cord, to be placed in a casing for the purpose of covering a break.

Camber.—Angle at which a wheel leans outward at the top.

Caster.—The amount of tilt in steering knuckle pivot backward.

Differential.—Mechanical device allowing two shafts driven by a common source of power to rotate at different speeds.

Driving axle.—Live axle; one that transmits power to the wheel.

Dual mounted (applied to two tires).—Attached to the same hub so that there can be no motion between the tires.

Live axle.—Driving axle; one that transmits power to the wheel.

Lug.—A piece used as a washer in fastening demountable rims, sometimes tapered to wedge between the wheel and the rim.

Mold.—A form used to vulcanize and shape rubber.

Multidrive.—Having more than two driving wheels.

Out of round.—Eccentric; not perfectly circular.

Recap.—To replace the tread rubber and form a design in it. A tire that has been recapped.

Retread.—To replace the breaker and the tread rubber and form a design in the tread. A tire that has been retreaded.

Rolling resistance.—The force, due to the contact between the tire and the road, which must be overcome to keep the vehicle in motion.

Tacky.—Sticky; like nearly-dry varnish.

Toe-in.—The angle at which the front of the front wheels point inward.

Traction.—Ability to resist slipping when power is applied.

Vulcanizing.—Process of heating uncured rubber so as to make it harder and stronger and sometimes to attach it permanently to another piece.

APPENDIX III

BIBLIOGRAPHY

The following sources were used in preparing illustrations and text for this manual:

1. Service bulletins, the Rubber Manufacturers Association, Inc., New York, N. Y. (published in series from time to time; approximately 20 bulletins now available).

2. Yearbook (1942), the Tire and Rim Association, Inc., Akron, Ohio.

3. Miscellaneous published and unpublished pamphlets, parts lists, and other materials provided by the following firms:

United States Rubber Co.
Goodyear Tire and Rubber Co.
B. F. Goodrich Co.
Firestone Tire and Rubber Co.
Dill Manufacturing Co.
A. Schrader's Son.

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